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JAHN (E.). **Über die angeblichen Arten des Hausschwammes.** [On the so-called species of dry rot.]—*Ber. dtsch. bot. Ges.*, lix, 6, pp. 233–245, 1941. [Abs. in *Holz Roh- u. Werkstoff*, v, 6, p. 211, 1942.]

Falck's four species of dry rot, namely, *Merulius domesticus* [*M. lacrymans*], *M. silvester*, *M. minor*, and *M. sclerotiorum* [*R.A.M.*, xvii, p. 216] are critically discussed. *M. silvester* is regarded as the 'wild' form of the true dry rot (*M. lacrymans*), which is not nearly as destructive as the latter at room temperature (20° C.), but was experimentally shown to be much more so at 15° to 16°. 'Wild' or 'sylvan' forms of well-known wood-destroying fungi are stated to be capable of intensive rotting at higher or lower temperatures than those normally prevailing in buildings. *M. silvester* is a physiologic race of *M. lacrymans*, *M. minor* an immature aberrant type of the same, and *M. sclerotiorum* a synonym of *M. hydnoides* P. Henn. The copious production of water by *M. silvester* in cultures at room temperature is attributed to the intensive secretion of liquid by the fungus as a result of adverse temperature conditions. There is also a 'wild' form of *Coniophora* [*puteana*] with quite different temperature curves.

HURYCH (A.). **Wood petrified with limonite. The use of limonite for the preservation of wooden objects and wooden structural work.**—*Plyn, Voda Zdrav. Tech.*, xx, pp. 69–70, 1940. [Russian. Abs. in *Chem. Abstr.*, xxxvi, 18, p. 5628, 1942.]

Spruce and pine timbers were protected from splitting and rotting by impregnation with a dilute solution of limonite, which penetrated deep into the pores and mineralized the wood. A thick slurry of the preparation (which is available commercially either as a liquid or paste) was then applied to the surface, where it hardened to a solid, tough, protective layer. The process should preferably be applied to the finished structure, which if necessary can subsequently be ground down and polished. The cost of the treatment does not exceed that of three coats of oil paint.

HOPKINS (J. C. F.) & PARDY (MARIE H.). **Diseases of fruit, flowers and vegetables in Southern Rhodesia. 6.—Virus diseases of Cabbages and Cauliflowers.**—*Rhod. agric. J.*, xxxix, 5, pp. 376–383, 17 figs., 1942.

A mosaic disease of cabbage in Rhodesia is stated to be either identical with or closely related to that described from Wisconsin [*R.A.M.*, xix, p. 65]. The earliest symptom is a marked yellowing of the veins followed by veinbanding and mottling. The leaf tips bend sharply outwards and downwards and the blades on each side of the midrib grow more vertically upwards than is normal. Later on, veinbanding becomes less distinct, growth is much retarded, heads fail to form, older leaves are shed, and dead areas and small black necrotic spots develop on the younger ones. The virus was experimentally transmitted by juice inoculation and by the aphids *Myzus persicae* and *Brevicoryne brassicae* to cabbage, cauliflower, and kohlrabi. The disease was favoured by high temperatures: in the greenhouse it developed best at 75° to 95° F. and was almost suppressed below 65°.

Dwarfing disease of cauliflower in Rhodesia is so named because it causes a severe dwarfing of the curds and often, but not invariably, of the whole plant. In the field, mottling is very prominent, followed by marked leaf distortion, minute raised blisters appearing on the under surface of the older leaves corresponding to minute, light tan-coloured spots on the upper side. In transmitted light such leaves can be seen to contain large numbers of translucent, yellowish spots and circles. Later a stipple of minute, black dots is formed on the under side, giving it a grey colour against which black spots stand out. In the late stages of the disease the severely distorted leaves with pronounced veinbanding are shed, the dwarfed and often loose curds becoming rapidly discoloured. Such curds are evil-smelling when cooked. The disease is favoured by low temperature and is suppressed above about 65°. The disease is transmitted to cabbage, cauliflower, and *Nicotiana glutinosa* by the same means as the cabbage disease. It does not resemble any of the known virus diseases and is believed to be due to either a hitherto undescribed virus or a mixture of viruses, one of which is possibly active in hot and another in colder weather. For the control of both the cabbage and the cauliflower disease it is essential to keep the beds free from weeds and old plant refuse and to practise roguing and spraying of the seed-beds. Weekly spraying with tobacco extract (1 in 500) and soap plus lead arsenate (3 lb. per 100 gals. wash) up to the time the plants were hearting helped to raise good marketable cabbages of the quicker-growing varieties, e.g., Early Jersey Wakefield and Copenhagen Market; the slower-growing, larger types were not so satisfactory and are not recommended for growing during the hot months.

JONES (R. A.). **Phosphorus deficiency blight for [of] Beets.**—*Proc. Amer. Soc. Sug. Beet Tech.*, pp. 66–68, [no date].—[Abs. in *Int. Sug. J.*, xliv, 523, p. 189, 1942.]

In 1926, a field of sugar beets in the Wheatland (Wyoming area) was observed to be dying. Normal growth was, however, found along certain irregular strips where refuse clover had been placed and burnt before the field was ploughed for the beets. It was assumed that the trouble was due to some deficiency supplied by the clover ash, and later on proof was obtained that it was in fact caused by phosphorus deficiency [cf. *R.A.M.*, xvi, p. 649; xxi, p. 278]. The first noticeable symptom of the condition, which is referred to as 'black heart blight', is a slight burning round the edge of the leaf, the tissues between the veins dying as injury progresses. It is found only in extremely deficient soils, representing a small percentage of the total beet area in the locality concerned, and is corrected by treble superphosphate application alone.

BOCKSTAHLER (H. W.). **Resistance to Fusarium yellows in Sugar Beets.**—*Proc. Amer. Soc. Sug. Beet Tech.*, pp. 191–198, 1940. [Abs. in *Sugar*, xxxvii, 10, p. 43, 1942.]

Fusarium conglutinans var. *betae* is reported to have caused up to 50 per cent. reduction in seedling sugar beet [*R.A.M.*, x, p. 428] stands in Colorado, Western Nebraska, South Dakota, Wyoming, and Montana. The foliage is mottled, later yellow, curled, and distorted, and the roots are grey externally and show an internal grey or brown discoloration of the vascular bundles. The course of the disease assumes the character of a slow, dry rot. Progress has been made towards the development of resistant varieties.

ANDRUS (C. F.) & WADE (B. L.). **The factorial interpretation of anthracnose resistance in Beans.**—*Tech. Bull. U.S. Dep. Agric.* 810, 29 pp., 2 figs., 1 diag., 3 graphs, 1942.

At the Bureau of Plant Industry, United States Department of Agriculture, Washington, D.C., the authors studied from 1932 to 1938 the mode of inheritance of resistance to three physiologic races (beta, gamma, and delta) of bean (*Phaseolus vulgaris*) anthracnose (*Colletotrichum lindemuthianum*) [*R.A.M.*, xi, p. 618; xiii,

p. 318], the first two supplied by W. H. Burkholder and the third (a new form) isolated from North Carolina material. Fifteen parent varieties and selections of differing reaction to the pathogen were used in 30 combinations, inoculations being made in the greenhouse on 145 F_1, 32,600 F_2, 108,000 F_3, and a considerable number of F_4 plants.

In the resistant × tolerant crosses, and reciprocal involving Perry Marrow, Boston Marrow, Canadian Wonder, and Geneva Red Kidney × Corbett Refugee, and Perry Marrow × Great Northern, resistance to beta was dominant, and this was also the case with resistant × susceptible and reciprocals (U.S. No. 1 Refugee, Selection No. 1, and Dark Red Mahogany × Geneva Red Kidney, Perry Marrow × U.S. No. 1 Refugee, and Canadian Wonder × Dark Red Mahogany). In two crosses of tolerant × susceptible (Dark Red Mahogany × Great Northern and the reciprocal) susceptibility was dominant. In the resistant × resistant crosses Robust × Small White and Small White × Boston Marrow all the progeny were resistant, while in No. 3 × Boston Marrow 99 were resistant and seven susceptible, approximating to a 15 : 1 Mendelian segregation. Similarly, certain susceptible × susceptible crosses yielded a few resistant individuals. Resistance in the tolerant × tolerant crosses (Great Northern × Corbett Refugee) appeared to follow a modified 13 : 3 ratio. Full particulars are also given of the results obtained with the gamma and delta races, and the conclusion is reached that a system of ten genes in three allelomorphic series, involving both duplicate and complementary genes for resistance, one dominant gene for susceptibility, and gene interactions at three points, is the simplest Mendelian hypothesis co-ordinating all the data for beta and gamma. A straightforward explanation (three independent pairs of genes) would fit the delta results, without necessarily excluding the more complex system. This hypothesis calls for 11 susceptible and 25 resistant parental genotypes, of which two of the former and five of the latter were apparently realized in the beta crosses alone. In the cross Corbett Refugee × Geneva Red Kidney and its reciprocal linkage was observed between the red seed-coat colour and susceptibility to races beta and gamma of *C. lindemuthianum*.

Sakr (El S.) & Thompson (H. C.). **Effect of infecting Carrot plants with certain viruses on seedstalk development.**—*Plant Physiol.*, xvii, 3, pp. 500–502, 1 fig., 1942.

In greenhouse tests carried out from 1939 to 1940 to ascertain the effect of temperature on seed-stalk development in carrots, certain yellowed plants formed seed-stalks earlier than others in the cool ranges of temperatures, while at the higher ranges (60° to 70° and 70° to 80° F.) they were the only ones that formed seed-stalks under some treatments. These plants were found to be infected with the eastern strain of aster yellows.

Inoculation of carrot plants with aster yellows induced the formation of seed-stalks which were not formed by inoculation with sap extract of either aucuba mosaic, latent virus of potato, lucerne mosaic, cucumber virus 1, or tobacco mosaic. No seed was set by the seed-stalks produced.

Thorne (D. W.) & Brown (J. C.). **Some characteristics of Utah chlorotic soils.**—Abs. in *Proc. Utah Acad. Sci.*, xviii, p. 11, 1941.

A survey of Utah County indicated that about 90 per cent. of the prevalent vine chlorosis [*R.A.M.*, xx, p. 557] is restricted to four soil series with profile characteristics similar to those of the Hyrum clay loam series, a study of a small area of which was accordingly conducted at the Agricultural Experiment Station to determine the factors associated with the disorder. The chlorotic patches were less thoroughly drained than the adjacent healthy ones and contained an average of 9 per cent. more lime in the upper foot. Considerably larger amounts of iron were extracted with 0·25 and 0·5 per cent. oxalic acid from non-chlorotic than from chlorotic soils. Iron

solubility would appear to be a function of the activity of lime as well as of the proportion of the latter in the soil.

MESTRES JANÉ (A.). **La lucha contra el mildiu.** [The anti-mildew campaign.]—*Agricultura, Madr.*, xi, 120, pp. 139–140, 1 fig., 1942.

According to an Italian estimate (March, 1941), the annual European consumption of copper for agricultural purposes, including the control of vine downy mildew (*Peronospora*) [*Plasmopara viticola*], amounts to 125,000 'toneladas' [1 'tonelada' = 20 quintals], of which the Spanish requirement is calculated by the writer at not less than 6,000. At Villafranca, one of the viticultural centres at which experiments in the use of copper substitutes are proceeding in connexion with the economy campaign [*R.A.M.*, xxi, p. 439], the following formulae have given satisfactory results against the disease: (1) 200 gm. copper sulphate per hl. plus gelatine; (2) 'eau céleste' (1 kg. copper sulphate per hl. rendered alkaline with ammonia); (3) copper ammoniate (25 gm. copper per hl. dissolved in ammonia); (4) Montpellier green (1·5 kg. basic copper acetate per hl. in suspension); (5) Menozzi's formula (1 kg. each of copper and iron sulphate per hl. made alkaline with lime) [ibid., xx, p. 622]; (6) copper oxychloride (1 kg. per hl.) preferably with an admixture of aluminium to secure adhesiveness; (7) copper-aluminium mixtures (1 kg. copper sulphate or oxychloride and 1·5 to 2 kg. aluminium sulphate per hl., made alkaline with lime); (8) Bruno mixture (1 kg. copper sulphate and 1·2 kg. trisodium phosphate per hl., made alkaline with sodium carbonate or lime); (9) Casale's mixture [ibid., xix, p. 581], known in Italy as ramital, which contains 200 gm. copper sulphate per hl. and has proved so efficacious that a Ministerial Commission authorized its widespread use in 1941 and large-scale production for 1942.

Memoria de los trabajos realizados por la Estación de Fitopatología Agrícola de La Coruña. Año 1941. [Report on the work performed at the Corunna Station of Agricultural Phytopathology during the year 1941.]—*Publ. Estac. Fitopat. agríc. Coruña* 20, 48 pp., 51 figs., 1 diag., 2 graphs, 1942.

P. URQUIJO LANDALUZE, continuing his investigations on chestnut ink disease (*Phytophthora cambivora*) [*R.A.M.*, xxi, p. 404], carried out comparative cultural studies of a local strain of the causal fungus isolated from *Castanea dentata*, walnut, and *Erica*, and the strains of Leonian and Petri, supplied by the Bureau voor Schimmelcultures, Baarn. According to their sporangial dimensions the strains were relegated to three groups, (1) Petri's and Leonian's, (2) the writer's local isolate (62·1 by 37·2 μ) and the walnut strain (63·6 by 40 μ), and (3) the *C. dentata* strain, Dufrénoy's strain [ibid., xiii, p. 336] and that from *Erica* (the subjects of earlier experiments) falling into the first and second groups, respectively. Spherical chlamydospores were produced by the local chestnut isolate and those from *C. dentata*, walnut, and *Erica*, but were uniformly absent from Petri's, Leonian's, and Dufrénoy's strains. Cultural studies of 538 isolates on various media clearly emphasized the differences between group (1) and groups (2) and (3).

Inoculation experiments were carried out on seedlings in nutrient solutions with pure cultures of the seven strains of *P. cambivora*, fragments of the mycelium of which were inserted through incisions into the hypocotyledonary axes or roots, the percentages of infection obtained with the local strain (comprising the bulk of the tests), Petri's, Leonian's, Dufrénoy's, and the isolates from *C. dentata*, *Erica*, and walnut being 99, 60, 85, 57, 100, 100, and 83 respectively. The copper oxychloride and copper carbonate treatments, already described, when applied to the roots of two-year-old transplants [ibid., xxi, pp. 434, 475] again proved efficacious: in the laboratory the lethal dose of the copper ion was found to be 1 in 100,000, the mycelium of the fungus failing to develop when re-sown on carrot roots after exposure to this concentration.

J. R. Sardiña compared two Spanish isolates of *Cytospora* sp. from chestnut [ibid., xxi, p. 404] with cultures of *Endothia parasitica* supplied by F. D. Heald and G. P. Clinton from the United States. The first-named differed from the others not only in pycnospore dimensions, but also in the production of a raspberry-coloured to carmine pigment on certain media, e.g., Richards's agar and Leonian's malt extract solution.

New records for the Corunna district include *Cronartium flaccidum* on peony, *Cylindrosporium mori* on mulberry, *Ovulariopsis haplophylli* (P. Magn.) Trav. on *Ruta graveolens*, *Puccinia* (?) *antirrhini* on *Antirrhinum majus*, *P. glumarum* on wheat, and the following grasses not hitherto known locally as hosts of *Claviceps purpurea*: *Holcus lanatus*, *Dactylis glomerata*, and *Brachypodium pinnatum*.

Zillig (H.). **Beiträge zur Adventivflora des Moselgebietes.** [Contributions to the exotic flora of the Moselle region.]—*Angew. Bot.*, xxiv, 3–4, pp. 352–393, 1942.

Among the items of interest in this survey of the exotic flora (including parasitic fungi, pp. 359–366) of the Moselle Valley may be mentioned the following. Tomato leaf mould (*Cladosporium fulvum*) is troublesome in wet seasons on outdoor plants as well as in the greenhouse. Little hope is entertained (September, 1941) of saving the white pine [*Pinus strobus*] stands attacked by *Cronartium ribicola* [*R.A.M.*, xv, p. 472], and this species will accordingly only be perpetuated in small plantings in *Ribes*-free districts. *Graphium* [*Ceratostomella*] *ulmi* has been present on elms in the vicinity of the Rhine and on the heights above Coblenz since about 1928 [ibid., xvii, p. 636], *Ulmus montana* and its hybrids being chiefly affected, though *U. campestris* is also liable to virulent infection. Direct control measures are impracticable and the removal of diseased trees is essential. The isolated local foci of potato wart (*Synchytrium endobioticum*) have been largely eliminated since their first appearance in 1926, and the exclusive cultivation of immune varieties [ibid., xix, p. 320] is expected to complete the process of extermination. A table is given showing the origin, hosts, year of first observation, and economic importance of the 17 pathogens enumerated.

Parham (B. E.). **Botanical note. Plant protection. (Notes from the Pathological Laboratory—III.)**—*Agric. J. Fiji*, xiii, 1, pp. 27–28, 1942.

In July, 1940, 'jak' (*Artocarpus integer*) trees near Naduruloulou were observed to be severely infected by *Rhizopus artocarpi* [*R.A.M.*, xii, p. 680], not hitherto recorded for the Colony. The young female inflorescences were covered with a grey, later black mass of sporangia surrounded by a paler fringe of immature sporangiophores. The rot progressed rapidly, causing mummification and shedding of the fruits within four or five days of its inception near the stem. Mechanical injury does not appear to be a necessary preliminary to infection.

A note is given on an outbreak of white rust (*Albugo candida*) [*Cystopus candidus*] on Chinese cabbage at Suva, where the disease was evidently favoured by the cool weather prevailing during June (average maximum and minimum temperatures 72° and 68° F., respectively), and the first fortnight of July (73° and 62°, respectively), the optimum for spore germination of the fungus and its maximum for growth being 56° and 77°, respectively. Preventive sanitary measures are briefly indicated.

Phytophthora hibernalis was first observed on orange fruits, causing the loss of an entire fruit crop, in 1941. Brief recommendations for control on the lines adopted in New South Wales [ibid., xix, p. 326] are given.

Plant pathology and physiology.—*Rep. Tex. agric. Exp. Sta. 1941*, pp. 64–73, 1942.

This report [cf. *R.A.M.*, xxi, p. 127] contains, *inter alia*, the following items of interest. In further work by W. N. Ezekiel on cotton root rot (*Phymatotrichum omnivorum*) evidence was obtained showing that losses attributable to infection may

be masked in average figures. The same increase in rainfall that conduces to the spread of root rot also encourages the growth of those cotton plants that have remained unaffected. Yield data made up by averaging yields from affected and unaffected fields can, therefore, conceal in the averages the losses caused by the disease. Percentage reduction in yield would appear to approximate to nine-tenths of the percentage of plants killed by the date of the first picking.

Successive transfer of young cultures of *P. omnivorum* resulted in a remarkable attenuation of the strain. The immediate cause, apparently, is neither accumulation in attenuated cultures of diffusible inhibitory materials (as a phage) nor lack of growth-promoting materials. The continued resistance (in greenhouse inoculation tests) of *Albizzia julibrissin* suggests that it is suitable for use in root-rot areas.

Ezekiel and Nelson found that root-rot prevalence can generally be reduced, in soils not too highly buffered, by applications of sulphur.

In studies of the growth reactions of *P. omnivorum* to amino nitrogens and of the absorption and utilization of inorganic nitrogen by the fungus [ibid., xxi, p. 287], Talley, Mason, and Blank found that arginine, alanine, asparagine, aspartic acid, glutamic acid, glycine, proline, and tyrosine were good sources of nitrogen, while moderate growth was obtained from cystine, leucine, iso-leucine, methionine, phenylalanine, and valine. Glycine anhydride, histidine, lysine, and tryptophane were poor nitrogen sources. Ammonium nitrate, nitrate salts, and ammonium salts were equally satisfactory as sources of nitrogen.

Eaton and Rigler found that the susceptibility of cotton plants to *P. omnivorum* is related to the carbohydrate levels in the root bark. In both field and greenhouse tests, fruitful, high-nitrogen plants with low concentrations of carbohydrates died within 10 days of inoculation, while low-nitrogen, defruited plants high in carbohydrates lived on. In a field experiment on Houston soil, autumn ploughing reduced the percentage of dead plants from 39 to 25·3 per cent. and increased yield by 36 per cent. The addition of 120 lb. nitrogen [? per acre] in autumn had no effect on root rot, but increased yields by 14 per cent. Spacing two plants every 28 instead of every 14 in. slightly reduced infection and slightly increased yield. In a new method of inoculating cotton plants with root rot Milo seeds are autoclaved and spread on plates of the fungus. Given numbers of the infected seeds are placed at uniform depths of about 1 in. from the tap-root, and the duration of the period elapsing between inoculation and death serves as a criterion of resistance.

A. L. Harrison placed six- to eight-week-old tomato plants in a spore suspension of *Alternaria solani* and then transferred them to a moist chamber for 24 to 60 hours. All varieties of tomato were found to be highly susceptible, while certain strains of *Lycopersicum pimpinellifolium*, *L. peruvianum*, and F hybrids of *L. esculentum* × *L. hirsutum* showed more resistance than any tomato variety tested. Grey spot (*Stemphylium solani*) [ibid., xii, p. 60] was prevalent on tomatoes in August and September, this being apparently the first record of the disease in Texas.

G. Ken Knight and A. L. Harrison state that four applications of a spray containing copper oxychloride and wheat flour (3–3–100) markedly increased the yield of cantaloupe melons during a severe epidemic of *Peronoplasmopara* [*Pseudoperonospora*] *cubensis*. Rather smaller yields were obtained with Bordeaux mixture (8–8–100) and with tribasic copper sulphate as a dust. Red copper oxide as a spray gave only slight yield increases and as a dust decreased yields.

A. A. Dunlap and E. W. Lyle, in experiments in co-operation with the United States Cold Storage Company, Dallas, designed to prevent excessive loss from neck rot [? *Botrytis allii*] in Bermuda white wax onions under cold storage conditions, found that considerable reduction in infection occurred when the onions were stored in wooden crates instead of sacks. Onions harvested during dry weather developed only 5 to 10 per cent. neck rot in storage, as against 20 to 50 per cent. among those harvested in rainy weather. Dusting with boric acid and sodium borate when storing

seemed to prevent neck rot and improved the appearance of the onions under cold storage conditions.

Watkins, H. F. Morris, and Langley state that after storage at 38° F. for 5½ months, peaches that had been treated with sulphur sprays against brown rot [*Sclerotinia fructicola*] showed 68 per cent. sound fruits, as against only 33 per cent. for the untreated lots. In this connexion it is pointed out that control of the Oriental fruit moth [*Cydia molesta*] is of the first importance, since brown rot decay follows injury by this insect.

LYLE (E. W.). **Effect of crop rotation on crown-gall and root-knot in east Texas experiment with Roses.**—*Sth. Flor.*, lii, 8, p. 7, 2 figs., 1941. [Abs. in *Exp. Sta. Rec.*, lxxxvii, 2, p. 244, 1942.]

Soil on which roses were severely attacked by crown gall [*Bacterium tumefaciens*] in 1937 was planted in the two following years with resistant crops, viz., Iron cowpeas, oats, and *Crotalaria*, half of the experimental area being replanted in December, 1939, with rose cuttings, some of which were treated with mercuric chloride (1 in 1,000). In October, 1941, about 3 per cent. of all the plants were infected by crown gall, as compared with 53 per cent. in 1937, the incidence of the pathogen on the treated and control cuttings being 0·97 and 5·66 per cent., respectively. Neither crop rotation nor disinfection was effective against root-knot nematodes.

FRIEDMAN (B. A.) & FRANCIS (T.). **Gall formation by Phytomonas tumefaciens extract and indole-3-acetic acid in cultures of Tomato roots.**—*Phytopathology*, xxxii, 9, pp. 762–772, 4 figs., 1942.

Excised tomato root tips, growing in nutrient solution enriched by indole-3-acetic acid at varying concentrations, developed galls resembling those produced by *Phytomonas* [*Bacterium*] *tumefaciens* [*R.A.M.*, xv, p. 782; xix, p. 202] and characterized by hypertrophy of the cortical and epidermal cells, marked meristematic activity of those of the pericycle, resulting in abundant formation of root primordia, some multiplication of the cortical cells, the occasional appearance of multinucleate cells in the pericycle and cortex, excessive production of root hairs with frequent apical swellings, and stimulation of callus growth at the cut root ends. The higher concentrations of the growth substance induced extensive fragmentation of the epidermal and cortical cells, as well as thickening and irregularity of the roots. Up to dilutions of about 7×10^{-9} moles per l., indole-3-acetic acid inhibited root elongation, reduced the number of branches formed, and decreased the total dry weight, the approximate lethal dose, killing some 90 per cent. of the roots, being 5 mg. per l. The chemical galls persisted after transference to fresh nutrient solution, in which all new growth, however, was normal. Tumour formation could not be induced by the addition to the medium of tryptophane, indole, or acetic acid, or by varying the hydrogen-ion concentration of the controls.

MEAD (H. W.), RUSSELL (R. C.), & LEDINGHAM (R. J.). **The examination of cereal seeds for disease and studies in embryo exposure in Wheat.**—*Sci. Agric.*, xxiii, 1, pp. 27–40, 3 figs., 2 graphs, 1942.

A full account is given of routine laboratory tests of 817 samples of wheat, oats, and barley grown in Saskatchewan in 1940 [cf. *R.A.M.*, xx, p. 566]. The results with wheat agree in the main with those of the previous year. A severe type of smudge was caused by *Helminthosporium sativum*; it was much less common than the ordinary mild type prevalent in the newer varieties, the cause of which has not yet been ascertained. Bunt [*Tilletia foetida* and *T. caries*] was found on 8·3 per cent. of the samples, which had an average spore load of less than 10 spores per kernel. Under the local conditions, average spore loads of about 120 spores per kernel for wheat and

200 for oats and barley generally produce 0·1 to 1 per cent. bunted heads in the crop. With wheat, an infection of 5 per cent. or more in the field would probably cause the threshed grain to be graded as 'smutty'.

With oats (165 samples) an average spore load of about 500 spores of smut [*Ustilago avenae* and *U. kolleri*] per kernel was found on 66 per cent. of the Vanguard samples, the corresponding figures for Victory being 180 spores on 82 per cent., for Banner 60 on 50 per cent., and for Gopher 80 on 75 per cent. *Alternaria* sp. was present on all samples, and several showed the presence of *Rhizopus* sp. and *Penicillium* sp. *H. sativum* was fairly common on the oat kernels when they were incubated. *Fusarium* sp. spores were occasionally observed in centrifuged washings.

The 63 barley samples tested included the O.A.C. 21, Rex, Plush, Royal, Prospect, and Olli varieties. An average spore load of about 75 smut [*U. hordei* and *U. nuda*] spores per kernel was found on 25 per cent. of the samples in some varieties and 60 per cent. in others, Regal and O.A.C. 21 having most. *H. sativum* occurred on 18 samples and its highest incidence was 1 per cent. on O.A.C. 21. The fungus causes root rot of barley if a virulent strain is present on the seed, and causes smudge of barley seed. This discoloration was found in 40 samples to an average extent of 1·5 per cent.

Tests with wheat seed showing embryo exposure (due to fractures) for susceptibility to mould [unspecified] demonstrated that in almost every instance, samples with severe exposure, when placed under conditions of high humidity, rapidly developed greater mould growth than less severely injured samples. When damp Apex wheat seed with high and low embryo exposure (92 and 18 per cent., respectively), was stored for 24 days, the severely damaged samples underwent a rapid rise in temperature. At the conclusion of the tests, abundant growth of thermophilic fungi was observed, together with *Aspergillus* spp. and some *Penicillium*. Examinations at intervals during one test showed *Penicillium* first, followed by *Aspergillus* and thermophilic species. It was concluded from these tests that embryo exposure and concomitant troubles might cause serious damage when conditions were suitable for fungal growth.

When wheat seed showing various degrees of embryo exposure was treated with lunasan, formalin, and ceresan and planted at Saskatoon and Indian Head, in the latter locality excellent growing conditions tended to submerge differences as between degrees of embryo exposure and the various treatments. At Indian Head, formalin caused distinct decrease in emergence, but this was not always reflected in the yield. The mercury dusts in some instances improved emergence and yield. At Saskatoon, there was a slight but distinct difference between the high and low embryo exposure samples, mainly shown in the yield results. Thus, in the untreated lots of one test there was a difference in reduced emergence of only 1 per cent. between the sample with 15 per cent. embryo exposure and that with 85 per cent., while the yield showed a difference of 9 per cent. In the same test, the lunasan-treated samples showed a general increase in emergence, but with a difference of reduced emergence of 3 per cent. between the samples containing low and high embryo exposure; the yield for the same two samples showed a reduction of 18 per cent. A similar relationship resulted in another test, in which ceresan was used. It is difficult to account for the reduction in yield in relation to emergence in these tests. Apparently, growth became retarded following emergence, this being reflected in the depressed yield. This depression reaction was increased by the mercury dusts under conditions of limited soil moisture. With formalin there was an improvement as the season progressed, but reduction was marked with severely injured seed. Stress is laid on the importance of estimating the amount of injury carried by seed samples before proper seed treatment can be recommended.

NEATBY (K. W.). **New varieties of spring Wheat resistant to stem rust in the Canadian West, and their genetical background.**—*Emp. J. exp. Agric.*, x, 40, pp. 245–252, 1942.

After referring to the fact that the problem of stem rust of wheat (*Puccinia graminis*) in the hard red spring-wheat area of Canada and the adjacent States has now, at least for the time being, been completely solved by the use of resistant varieties, the author briefly reviews the genetical phases of the breeding work involved, and shows how genetical research simplified the problem. The aspects of the matter dealt with cover the existence of 'groups' of physiologic races from which one wheat variety might be immune, 'mature-plant' resistance, not fully expressed until the heading stage or later, comparative field tests from 1935 to 1941 with Marquis, Apex, Renown, Regent, and Thatcher wheat, the use of breeding material from Manitoba and Kenya, and the distribution of the various resistant varieties in the prairie provinces.

In the comparative field tests at the Dominion Rust Research Laboratory, Winnipeg, during 1935 to 1941, inclusive, the figures for mean percentage stem rust infection for Marquis, Apex, Renown, Regent, and Thatcher wheats were, respectively, 68, 3, 1·3, 1·1, and 9·1 per cent.; the mean yields were, respectively, 11·5, 22·8, 27·8, 29, and 26·8 bush. per acre, while at Brandon, Manitoba, under conditions of natural infection, they were 24·7, 34·3, 38·1, 39·1, and 41·4 bush. per acre. In 1941, the varieties Thatcher, Apex, Renown, and Regent occupied 91·7 per cent. of the Manitoba wheat acreage and 79·2 of the Saskatchewan acreage. Thus, susceptible varieties have virtually disappeared from the 'rust area' since 1936. This 'rust area' occupies the central and southern part of the farming area of Manitoba, and southern and east-central Saskatchewan.

It is concluded that the solution of the stem-rust problem in the locality concerned is an achievement of outstanding merit. It has resulted from the combined efforts of breeders, pathologists, agronomists, and chemists. Quite apart from the immense economic benefits which have resulted, the work has also contributed very substantially to existing knowledge of the biology of *Puccinia* spp., the genetics of resistance, and factors affecting 'wheat quality' and its measurement.

GARCIA-RADA (G.), VALLEGA (J.), LOEGERING (W. Q.), & STAKMAN (E. C.). **An unusually virulent race of Wheat stem rust, No. 189.**—*Phytopathology*, xxxii, 8, pp. 720–726, 2 figs, 1942.

A hitherto undescribed physiologic race designated No. 189 of *Puccinia graminis*, isolated from Khapli emmer in Peru [*R.A.M.*, xxi, p. 184], is distinguishable from every other known strain of the rust by its ability to attack all the differential wheats used for purposes of identification, as well as the otherwise uniformly resistant *Triticum timopheevi*, besides virulently infecting Hope, a generally resistant variety. The new race appears to be distributed along the Peruvian coast from Lambayeque to Lima, where it is suspected of having been present for upwards of 20 years, but has not been found elsewhere in South America or isolated from either wheat or barberry in the United States during a similar period. Particulars are given of the inoculation experiments conducted with race 189 in the greenhouse and field at St. Paul, Minnesota. The most important feature of the Peruvian isolate is its high degree of pathogenicity to adult plants of normally resistant varieties, including Khapli, which in extensive and exacting tests has withstood every spring wheat rust epidemic of the last 30 years with the minimum of infection, except that of 1916, and even then the pustules numbering about half those counted on the susceptible varieties, were small. The possibilities of dissemination of race 189 from Peru to other South American countries and the States are briefly discussed.

SALLANS (B. J.). **The importance of various roots to the Wheat plant.**—*Sci. Agric.*, xxiii, 1, pp. 17–26, 1 graph, 1942.

Further experiments were carried out in Saskatchewan from 1934 to 1939 to ascertain the relative importance of the seminal and crown root systems of wheat plants as determined by root amputations under ordinary crop conditions [*R.A.M.*, xii, p. 501]. The roots amputated were the true seminal roots, including the primary root, the first and second pair of lateral roots, the sixth seminal root, and the coleoptile axillary roots, sometimes classed as seminal roots.

The results demonstrated that when the various roots are well established they contribute independently of each other to the water and mineral supply of the plant, as indicated in the final yield of grain. The individual root that contributes most to the final yield is the primary seminal root, while the first pair of lateral seminal roots is about equally important. These three roots are almost always produced by seedlings growing under normal conditions. The second pair of seminals, the sixth seminal, and coleoptile axillary roots were found to be of considerably less use to the plant than the first three seminal roots. The contributions of the crown roots, while individually small, were generally larger in the aggregate than those of the seminal roots.

Browning root rot of wheat [*Pythium* spp.: ibid., xiv, p. 748] frequently causes an amputation of the crown roots by rotting the growing tip or a segment of the root behind the tip. A loss in the number of crown roots results, and from the findings in the present paper, there is a corresponding loss in final yield. The higher the percentage loss of crown roots, the greater is the loss in yield. The main axes of the seminal roots generally escape being rotted off but the lateral branches become severely rotted, the efficiency of the seminal roots being much reduced. The action of the fungus here is to amputate the rootlets rather than the main roots, but the effect is similar, as the effective absorptive surface is considerably diminished. The growing points remain active, and the roots continue to grow down into soil layers relatively or entirely free from the fungus. Hence, the plants may show a retarded recovery.

With take-all [*Ophiobolus graminis*] different degrees of root amputation may occur, the results ranging from a slight yield reduction to the death of the plant.

Common root rot (*Helminthosporium sativum* and *Fusarium* spp.) does not, as a rule, induce effective root amputation in Saskatchewan. There may be some reduction in the numbers of the lateral branches and in the number of seminal roots; there is much stunting and reduction of yield. Growth vigour is lessened, and if infection occurs before crown root formation, the number of such roots may be greatly reduced.

JOHNSTON (C. L.) & GREANEY (F. J.). **Studies on the pathogenicity of Fusarium species associated with root rot of Wheat.**—*Phytopathology*, xxxii, 8, pp. 670–684, 1942.

At the Dominion Laboratory of Plant Pathology, Winnipeg, greenhouse pot experiments were conducted to determine the relative pathogenicity to Marquis wheat seedlings and mature plants of 24 isolates of *Fusarium culmorum*, and one each of *F. redolens*, *F. oxysporum* var. *aurantiacum*, *F. avenaceum*, and *F. equiseti*, all common occupants of rotted wheat roots and of grain soils in Manitoba [*R.A.M.*, vii, p. 312; xvii, p. 668; xx, p. 353, *et passim*].

Of the *F. culmorum* strains, only one (38 isolated from wheat at Rhodes in 1932) was definitely pathogenic to both young and adult plants, causing disease ratings of 88 on the former and 59 on the latter, reducing the incidence of emergence in the seedlings from 82·2 to 40·1 per cent., the green weight of young and mature plants from 65·2 and 126·1 to 9·7 and 88·4 gm., respectively, and lowering the grain yield from 22·3 to 11·1 gm. per plant. *F. avenaceum* and *F. equiseti* were scarcely, if at all, pathogenic to the seedlings, but attacked the older plants to a considerable degree

(32·4 and 26·8 disease ratings, respectively, resulting in yield reductions from 22·3 to 15 and 16·7 gm., respectively) while *F. oxysporum* var. *aurantiacum* and *F. redolens* did not cause appreciable damage to either group. Field tests with these fungi gave essentially similar results.

The moisture content of the soil (40 or 60 per cent. of its water-holding capacity) did not significantly influence the virulence of the fungi under observation, but the pathogenicity of *F. culmorum* increased with rising temperatures from 10° to 25° C. whilst *F. avenaceum* was pathogenic (but only weakly) at 25°, and *F. redolens*, *F. oxysporum* var. *aurantiacum*, and *F. equiseti* were not pathogenic at any temperature tested. In pot tests, *Trichoderma lignorum* [*T. viride*] and *Pyronema confluens*, both common inhabitants of the soil, noticeably lowered the pathogenicity of *F. culmorum* 38, especially at 10°, whereas *Penicillium imbricatum* and *Aspergillus flavipes* exerted no adverse effect on the infective activity of either *F. culmorum* or *F. redolens*.

Harris (R. H.) & Sibbitt (L. D.). **The quality of North Dakota durum Wheat as affected by blight and other forms of damage in 1940.**—*Cereal Chem.*, xix, 3, pp. 403–410, 2 graphs, 1942.

A tabulated account is given of the writers' preliminary investigations at the North Dakota Agricultural Experiment Station to determine the extent of the damage to processed durum wheat (semolina and macaroni) resulting from 'black point' (*Alternaria* spp. and *Helminthosporium sativum*) and other fungal infections, including scab (*Gibberella*) [*zeae*: *R.A.M.*, xx, p. 524].

It was found that slightly injured kernels, in which discoloration is confined to the tip, could be tolerated in a proportion up to 10 per cent. with good milling durum, while 25 per cent. does not appreciably impair the colour of macaroni or increase 'speckiness' in semolina. On the other hand, an incidence of 50 per cent. would entail a very high risk in the mill mix.

A more critical situation arises with the inclusion in the blend of heavily damaged kernels, the presence of 5 per cent. significantly increasing 'speckiness' in semolina and decreasing the macaroni score, 10 per cent. being highly detrimental, and 50 per cent. resulting in grade reduction from No. 1 Hard Amber to Sample Grade, which would involve the grower in a serious financial loss.

Zazhurilo (V. K.) & Sitnikova (Mme G. M.). Взаимоотношение между вирусом мозаики озимой Пшеницы и его переносчиком—полосатой цикадкой (**Deltocephalus striatus L.**). [The relation of the virus of winter Wheat mosaic to its vector (*Deltocephalus striatus* L.).]—*C.R. Pan-Sov. V. I. Lenin Acad. agric. Sci., Moscow*, vi, 11, pp. 27–29, 1941.

In experiments carried out in 1940 at the Plant Protection Station, Voronezh, the virus of winter wheat mosaic [*R.A.M.*, xxi, p. 251] was successfully transmitted through *Deltocephalus striatus* [ibid., xx, p. 387], but not through *Delphax striatella*, *Cicadula sexnotata*, *Eurigaster integriceps*, *E. maurus*, *E. austriacus*, *Aelia acuminata*, or *Haplothrips tritici*. *Deltocephalus striatus* transmitted the virus from winter wheat to winter and summer wheats, oats, barley, rye, and millet [? *Panicum miliaceum*] and from some of these hosts to others, indicating that mosaic in all these hosts was caused by the virus of winter wheat. The incubation period of the virus in the insect (average of 75 insects) varied from 5 to 35 days, but was mostly 15 to 16; in the plant, after infection, it varied with the air temperature, lasting 22 days at a daily average of 10° to 15° [C.], 15 at one of 15° to 20°, nine at one of 20° to 25°, and up to 25 or 30 at temperatures below 10°. The insects retained their infectivity for a considerable time: 78·6 per cent. for five days, 7·9 per cent. for 40, and individual insects for as long as 60. Insects of both sexes and in all stages of development were capable of transmitting the virus, but only the first three larval stages were receptive to it.

In general, long feeding times were essential for the insects to become infected; thus, 6·5 per cent. of the larvae in the first stage became infected after 24 hours, 11·7 per cent. after two days, and 51·4 per cent. after five, but in no case did all the feeding insects become infected. The progeny of infective females was sterile, indicating that the virus was not transmitted through the eggs. These results lend support to previous conclusions that contact must be avoided between sources of infection in the field (stubble of spring cereals) and newly hatched generations of the vector, of which the most dangerous is the third, for it transmits the disease to the young stands of winter wheat where the virus overwinters. It is, therefore, of the greatest importance to destroy the infected stubbles by deep ploughing immediately after the harvest of spring crops and before the emergence of winter wheat.

GALACHIAN (P. M.). К проверке патогенности штаммов **Bact. atrofaciens McCull.** в лабораторных условиях. [Testing the pathogenicity of strains of *Bact. atrofaciens* McCull. under laboratory conditions.]—*C.R. Pan-Sov. V. I. Lenin Acad. agric. Sci., Moscow*, vi, 11, pp. 40–43, 3 figs., 1941.

In tests conducted during 1939 and 1940 at the Laboratory for bacterial diseases of the Pan-Soviet Institute of Plant Protection, Moscow, all but five of the over 70 strains of *Bacterium* [*Pseudomonas*] *atrofaciens* isolated from glumes, grains, and leaves of wheat [*R.A.M.*, xv, p. 669] and barley proved pathogenic to wheat and barley, respectively. The quickest and most effective method of testing the pathogenicity of the organism under laboratory conditions was to inoculate 24 hours' old agar cultures of the bacterium into the shoots and leaves with the help of a sterile needle. The strains varied in their virulence, the most pathogenic causing lesions on shoots 48 to 72 hours after inoculation and on the leaves after three to five days. Inoculation of the more virulent strains from wheat into barley and similarly from barley into wheat plants gave positive results. When inoculated into slices of potato the organism produced a rotting within 5 to 14 days. In comparative tests with other fluorescent bacteria, all the eight strains of *P. atrofaciens* tested proved pathogenic to shoots and seedlings of wheat and barley and to slices of potato, whereas *Bact.* [*P.*] *fluorescens*, *Bact. xanthochlorum* [*P. xanthochlora*], and *Bact. tabacum* [*P. tabaca*] produced no infection whatever.

MEAD (H. W.). **Host-parasite relationships in a seed-borne disease of Barley caused by Helminthosporium sativum Pammel, King, and Bakke.**—*Canad. J. Res.*, Sect. C, xx, 10, pp. 501–523, 3 pl., 4 figs., 2 diags., 1942.

Histological studies of barley kernels naturally infested in the field with *Helminthosporium sativum* showed that mycelium was present in all the seed coverings except the innermost layer of the pericarp on the neutral side of the kernels. It was usually present towards the ends, especially the proximal end, where most of the discoloration occurs. The superficial mycelium was mostly dark, thick-walled, and highly septate, and contained protoplasm. It was present on the surface of, between, and within the cells of the various seed coverings. Points of penetration of the outer epidermis of the pericarp were recognizable as small translucent spots surrounded by areas staining red in acid fuchsin. Invasion of the cells did not appear to kill them immediately, but most of the invaded cells had collapsed, and contained a brown deposit. There was some indication also of cell reaction in advance of the hyphae. Mycelium was seen in the remnants of the lodicules. Spores were found between the lemma and palea where the glumes overlap. Many had germinated and produced mycelium which grew inwards over the pericarp and outwards over the palea.

Observations on kernels from experimentally inoculated heads indicated that if inoculation of hulled barley kernels by a virulent form of the fungus occurs at or shortly after flowering, the ovaries die, and the other parts of the spikelet become

infected. If inoculation occurs five to ten days later, the glumes, pericarp, and lodicules are invaded, and areas of brown, dead tissue develop, which contain a thick-walled, highly septate mycelium. Hyphal penetration beyond the inner integument was not observed. Infection of 15 to 20 days old kernels was limited chiefly to the pericarp and the parenchyma of the glumes at both ends of the kernel; there was no shrivelling at this stage.

When affected kernels and seedlings were studied during germination, five degrees of infection were observed: (1) complete blighting of plumule and radicle at a very early stage, (2) early blighting of the unemerged shoot with infection soon spreading to the roots, (3) post-emergence blighting of shoots and roots, (4) stunting due to basal infection, and (5) surface lesioning of shoot and roots with fairly strong growth. The fungus was also ascertained to spread from the seed into the adjacent soil to a limited extent.

Further evidence demonstrated that when seed-borne, *H. sativum* is able to cause injury to barley seedlings under a somewhat wide range of temperature conditions, if in the presence of sufficient moisture to give good growth. Seedling blight was the most serious injury, but light infection also spread over the base of the plants, involving the roots, sub-crown internode, and leaves. In most cases, severe early infection caused stunting and early death. In general, there was considerable recovery from the effects of infection, where competition for moisture was not severe. Even when the extent of seed infection was known, it was not possible to predict the amount of injury that would ensue, for this seemed to involve various factors affecting host and parasite.

Semeniuk (W.) & Ross (J. G.). **Relation of loose smut to yield of Barley.**—*Canad. J. Res.*, Sect. C, xx, 10, pp. 491–500, 3 graphs, 1942.

In a study of the effect of barley loose smut (*Ustilago nuda*) on yield the authors devised a method of inoculation by which infected spikes of Rewal barley (C.A.N. 1089) were allowed to dry overnight in the laboratory at room temperature, then ground up and passed through a 144-mesh fly screen. The sifted inoculum was placed in a four-layer cheese-cloth bag, and the chlamydospores scattered by hand over the barley heads, when these first emerged, early in July. This dusting process was carried out every evening for a fortnight, until all but the latest tillers had headed, four quarts of chlamydospores being used on about 80 sq. yds. of plants. At harvest, the youngest and consequently uninoculated spikes were pulled out and discarded. Greenhouse tests of the infected seed lots produced in 1938 and 1939 showed 15·5 and 33 per cent. infection, respectively. The seed so obtained was mixed with various proportions of normal, healthy seed to make samples with different percentage levels of affected seed, and these mixtures were planted in replicated field trials at three stations in each of two years. The relationship of yield to percentage of loose smut was then determined.

In the 1939 trials, no significant correlations were obtained between yield of barley and percentage infection. In 1940, however, a direct linear relationship was established between percentage incidence of loose smut and reduction of yield, yield being reduced for every 1 per cent. increase in infection by 0·85 per cent. at St. Paul, Minnesota, 1·4 per cent. at Edmonton, and 1·2 per cent. at Fallis, Alberta. These regression coefficients are not significantly different.

Infection did not appear to affect tillering. At all three stations similar degrees of smut were obtained for comparable seed lots. As the rate of seeding was increased, higher infections resulted. At Edmonton, incidence was the same on the basis of percentage affected spikes as on the basis of percentage affected plants.

Miles (L. E.) & Epps (J. M.). **The downy mildew disease of Oats, caused by Sclerospora macrospora.** *Phytopathology*, xxxii, 10, pp. 867–878, 2 figs., 1942.

Sclerospora macrospora was collected on oats in Sunflower County, Mississippi, in the spring of 1939, this being the first record of the downy mildew for the State and its first occurrence on the host in question in the United States. The diseased plants were characterized by stiff, curled, and fleshy leaves, and a short, twisted rachis, producing few spikelets, and those mostly sterile; the panicles sometimes exhibited a scattered, drooping aspect, and the barren seed-like structures were markedly elongated and somewhat curved. Other features of the mildew included curtailment of the internodes, excessive tillering, and the development of numerous reddish-brown streaks and small ruptured areas from the bases to the tips of the leaves.

The few bearded wheat plants attacked by *S. macrospora* in an infested field of oats were much distorted and sterile, the abnormally elongated rachis frequently separating the spikelets and giving the head a loose appearance; in some cases the rachis was bent backwards so that the head formed a circle or compact knot. The awns were also curled and distorted. Oospores were abundant in the leaves, glumes, and awns.

The oospores of the fungus were found in all the aerial organs of the affected oats plants, especially the foliage and glumes, their average diameter (335 individuals) in 1939 and 1940 being 55·6 μ, the corresponding dimensions for two lots of 100 each from New South Wales being 58·6 and 61·8 μ, respectively. Oospores from collections of *S. macrospora* from wheat in Tennessee and Kentucky, Delaware, and various parts of Italy averaged 62·5, 60·9, and 59·6 μ in diameter, respectively. These figures agree reasonably well, irrespective of locality and host, but those for rice and *Syntherisma sanguinale* from Japan and for *Avena fatua* from New South Wales were much smaller, averaging 50·8 and 47·9 (two collections), 44·9, and 48 μ, respectively, while the corresponding figures for specimens from *Bromus commutatus* (Tennessee) and *Eragrostis major* (New South Wales) were 60·1 and 62·3 μ, respectively [cf. *R.A.M.*, xx, p. 457].

As regards the perpetuation of the pathogens, there is considered to be little doubt that it overwinters in infested soils through the agency of the oospores, which are invested and protected by a thick, hard, persistent wall, though germination of the oospore has not yet been observed. Dissemination from one locality to another is effected by means of trash, e.g., leaf and glume fragments, in the seed, and by wind and erosion.

Fawcett (H. S.), Bitancourt (A. A.), & Wallace (J. M.). **Wood alteration in psorosis of Citrus in relation to tree decline.** Abs. in *Phytopathology*, xxxii, 9, p. 828, 1942.

In citrus psorosis A and B [*R.A.M.*, xx, p. 175], the primary lesions in the wood consist of gum in and between part of the vessels, while secondary injuries in the same site result in irregular discoloration and necrosis. The latter usually develop after the branch or trunk is girdled by the primary cortical and wood lesions. Suction experiments in drawing water or aqueous stains, e.g., 0·5 per cent. acid fuchsin or safranin, through the wood indicate that the primary lesions do not significantly impede the passage of water, whereas the secondary injuries, together with a region contiguous to that visibly affected, are impervious to the transit of fluid. These zones are co-extensive with those free from starch. Larger amounts of air were experimentally shown to pass through psorosis-diseased than through normal bark, in which the lenticels were the sole channels of slow air percolation. The obstruction of water passage by the secondary lesions appears to constitute the principal factor in tree decline. The alterations and discoloration of the central wood layers are probably a sequel to their starvation through the blocking by gum, in the primary wood lesions nearer the surface, of the inward passage of food.

BITANCOURT (A. A.) & FAWCETT (H. S.). **Statistical studies of distribution of psorosis cases in Citrus orchards.**—Abs. in *Phytopathology*, xxxii, 9, p. 827, 1942.

Most cases of citrus psorosis appear to be due to the utilization of buds from diseased parent trees [cf. *R.A.M.*, xix, p. 86], and the various operations from the collection of bud sticks to the final planting in the orchard usually afford ample scope for a thorough randomization. The comparison of the mean number of cases in the four trees adjacent to diseased and healthy ones, respectively, showed highly significant differences in seven orchards, a significant difference in one, and no significant difference in three. In those eleven cases there were more infected trees adjoining diseased than next to healthy ones. In an orchard with a very low incidence of psorosis, a non-significant difference was found in favour of the sound trees. The same analysis made independently for the two adjacent trees along rows and the two adjacent trees along arrays showed significant differences in both directions in five orchards, along rows only in one, and along arrays only in two. Systematic disposition of diseased trees along rows or arrays at planting time is thus indicated in the last three cases, while transmission from infected to healthy trees is the most plausible explanation for the five others.

CHAPMAN (H. D.) & BROWN (S. M.). **Potash in relation to Citrus nutrition.**—*Canning Age*, xxiii, 11, pp. 581–582, 1942.

Acute potassium deficiency in citrus induces twisting and crinkling of the leaves, the production of weak, flaccid, S-shaped lateral shoots, and the development on the foliage of vein-yellowing and yellow spots, markings, or stipplings. The marginal discoloration and scorching so common in other plants suffering from potassium deficiency are conspicuously absent.

Boron accumulated sufficiently in potassium-deficient lemon cuttings to produce the typical leaf patterns of boron excess, while leaf scorch from high sodium was somewhat accentuated in the test plants and transient iron chlorosis patterns on the foliage were also frequently observed. High calcium and magnesium in the culture solutions slightly expedited the appearance of potassium-deficiency symptoms, which were retarded (in an acute form), on the other hand, by high sodium. Though requiring further confirmation, a potassium content of less than 0·2 per cent. in leaves picked from July to September is probably indicative of deficiency, while 1 to 3 per cent. is an ample supply. The fruit from potassium deficient trees, though small, was not of poor quality, whereas an excess of this element resulted in large, coarse, low-grade fruit susceptible to rot.

GILLETT (S.). **Results and observations of spraying trials using Bordeaux mixture on Coffee at the Scott Agricultural Laboratories.**—*Mon. Bull. Coffee Bd Kenya*, vii, 75, pp. 30–31, 1942.

This is a tabulated account and discussion of the results of an eight-year (1934 to 1941) series of experiments in the control of physiological leaf fall of Bourbon coffee by spraying with carbide Bordeaux mixture, the beneficial 'tonic' effect of which on the output of the treated trees presumably operates through the foliar assimilatory system, since no question of fungicidal action arises. Each of the eight experimental plots consisted of 49 trees and was surrounded by one unsprayed boundary row, the treatments applied being as follows: A, 1 per cent. carbide Bordeaux each year in March; C (B was omitted from the trial), the same in March and June; D, 0·5 per cent. in March; F, the same in March and June; E, control; G, 1 per cent. Burgundy mixture in March; H and I (1938 to 1941 only), 4 per cent. carbide Bordeaux at the rate of 2·5 pint per tree, applied with a fog sprayer once (in March) to the former and twice (March and June) to the latter. For the other five plots a power headland pump was used to spray at the rate of ½ to 1 gal. per tree.

The average yields (in cwt.) obtained from the eight-year series (plots A, C, D, F, G, and E) were 9·7, 9·4, 8·3, 10·4, 9·5, and 4·8, respectively, the first five representing percentage increases over the control of 102, 96, 73, 117, and 98, respectively. The two four-year plots H and I yielded 6 and 9·9 cwt., respectively, corresponding to percentage increases of 9 and 80 per cent., respectively, over the 5·5 cwt. of the control.

Fog spraying was introduced mainly with a view to overcoming the difficulty of water shortage and also on grounds of economy. Two applications by this method should not cost more than 10*s.* per acre or consume more than 50 gals. water, compared with 12*s.* to 15*s.* per acre and 400 gals., respectively, for the pump. The average increase in output from all the plots except H was 4½ cwt. clean coffee per acre, representing an additional gross income of £9 per acre, so that the extra expense of spraying is obviously negligible.

Pending the development of some more appropriate remedy for leaf fall, spraying in areas similar to those surrounding the Scott Agricultural Laboratories, embracing a large portion of the Kiambu coffee zone, appears to be not only economic but essential. Spraying resulted in superior leaf coloration and better retention, and the flavour of the finished product was not, in general, perceptibly impaired.

Di Fonzo (M. A.). **El tratamiento de la semilla del Algodonero con productos anticriptogamicos.** [Treatment of Cotton seed with fungicidal products.]—*Bol. Junta nac. Algodon, B. Aires, 1942*, 81–82, pp. 43–51, 1 diag., 8 graphs, 1942.

Full details are given of laboratory and field experiments (the latter in two widely separated districts of the Argentine, Chaco and Santiago del Estero) to determine the value of cotton seed treatment for the control of fungal diseases, especially those due to *Rhizoctonia* [*Corticium*] *solani*, *Glomerella gossypii*, and *Phytomonas* [*Xanthomonas*] *malvacearum* [*R.A.M.*, xxi, p. 417]. In both localities the best results were given by granosan No. 4 (8 gm. per kg.) closely followed by abavit 192 (universal), with germination percentages of 73·2 and 68·8, respectively, in Chaco and of 46·6 and 45·3, respectively, in Santiago del Estero, the corresponding figures for the two controls in each series being 58·2 and 46·3 and 41·4 and 40, respectively. Another factor liable to reduce the germinability of cotton seed, the moisture content of which under local climatic conditions averages 12 per cent., is infection by organisms of the yellow mould (*Aspergillus wentii*) [see next abstract] group. There was no reduction of germination in seed with an 8·5 per cent. moisture content after four months' contact with a fungicidal dust (4 to 12 gm. per kg.).

Di Fonzo (M. A.). **La humedad de la semilla del Algodonero relacionada con su poder germinativo y con la presencia del Aspergillus wentii.** [The moisture content of Cotton seed in relation to its germinative capacity and the presence of *Aspergillus wentii*.]—*Bol. Junta nac. Algodon, B. Aires, 1942*, 85–86, pp. 156–168, 3 figs., 9 graphs, 1942.

In laboratory experiments to determine the relationship of infection by *Aspergillus wentii* to the reduction of germinative capacity in cotton seed (Acala Blue Tag and Delta 11 A) of varying moisture contents, the fungus was found to assume an actively injurious form when the moisture content ranged from 11·2 to 15·2 per cent. Humidity alone was shown to be an important contributory factor to the loss of germinability in cotton seed, one lot of which, with an initial germinative capacity of 95·7 per cent., lost 33·5 per cent. in ten days in an Erlenmeyer flask containing sulphate to saturation (98 per cent. humidity), while the addition to the flask of inoculum of *A. wentii* resulted in a decline of 74·5 per cent. of germinative energy during the same period. Seed treatment with an approved fungicidal dust is a simple, economical, and effective method of protection against damage from this source.

Armstrong (G. M.), Hawkins (B. S.), & Bennett (C. C.). **Cross inoculations with isolates of Fusaria from Cotton, Tobacco, and certain other plants subject to wilt.**—*Phytopathology*, xxxii, 8, pp. 685–698, 1942.

A tabulated account is given of cross-inoculation tests at the South Carolina Agricultural Experiment Station with the species of *Fusarium* isolated from cotton, tobacco, *Hibiscus esculentus*, tomato, watermelon, cowpea, and *Cassia tora*, carried out mostly by means of a solution-culture technique [*R.A.M.*, xx, p. 531] with some supplementary soil inoculations. The isolates from cotton, *H. esculentus*, *C. tora*, and Burley tobacco from South Carolina and Kentucky were reciprocally pathogenic, indicating the apparent involvement of a single fungus, to which, however, the flue-cured Gold Dollar tobacco variety was highly resistant. On the other hand, tobacco isolates from Maryland induced wilting of both types of tobacco, but not of cotton or *H. esculentus*. *C. tora*, a weed of cotton fields, was attacked by the agent of cotton wilt (*F. vasinfectum*). The species affecting tomato (*F.* [*bulbigenum* var.] *lycopersici*), watermelon [*F. bulbigenum* var. *niveum*], and cowpea [*F. tracheiphilum*] appear to be pathogenic only to their own or closely related hosts, since the tomato isolate was innocuous to watermelon, *H. esculentus*, and cotton, the watermelon strain failed to attack tomato, and the cowpea isolate caused no infection either of cotton or *C. tora*. The possible bearing of these data on the taxonomy of *F. vasinfectum* is discussed. Four attempts to differentiate culturally eight monospore isolates of *F. vasinfectum* by the technique of Coons and Strong, using malachite green and crystal violet dyes, gave inconsistent results. The authors conclude that the morphological studies so far recorded fall far short of providing a satisfactory method of identification for many of these fungi.

Vertinsky (K. I.). **Food poisoning in Horses due to Stachybotrys alternans.**—*Sovetsk. Vet.*, *1940*, 5, pp. 61–68, 1940.

Moseliani (D. V.). **Stachybotrys infection in Horses.**—Ibid., *1940*, 10, pp. 42–44, 1940. [Russian. Abs. in *Vet. Bull.*, *Weybridge*, xii, 12, p. 577, 1942.]

Stachybotrys alternans, the agent of acute poisoning of horses first observed in the U.S.S.R. in 1935–6, was shown to multiply and produce toxin only in dead, moist fodder, well-dried cellulose substances with a moisture content below 20 per cent. being free from contamination.

Pratt (H. N.) & Crossman (Ruth). **The comparative atopic activity of Alternaria spores and mycelium.**—*J. Allergy*, xiii, 3, pp. 227–230, 1942.

By direct testing of ten patients sensitive to *Alternaria* [*R.A.M.*, xxi, p. 452], a minimum of 95 per cent. of the atopic excitant in the spores was found to reside in the protein nitrogen, while further experiments on 25 persons of similar allergic constitution showed the spores to be at least ten times stronger than the mycelium in atopic excitant. Reagins were present for both spores and mycelium, but whereas mycelial extracts neutralized only reagins from the same source, conidial extracts consistently neutralized both spore and mycelial reagins. Extracts for the testing and treatment of atopic patients should, therefore, be prepared from the spores and not from the whole mat, which includes a quantity of incomplete mycelial antigen.

Duncan (J. T.). **Systemic mycoses.**—*Lancet*, ccxlii, 6187, pp. 393–395, 1942.

This is a review of the present status of knowledge concerning the symptomatology, etiology, geographical distribution, and therapy of the following systemic mycoses of man: coccidioid granuloma (*Coccidioides immitis*), Gilchrist's or Chicago disease (*Mycoderma* [*Blastomyces*] *dermatitidis*), sporotrichosis (*Sporotrichum schenckii* and *S. beurmannii*), torulosis (*Torula histolytica*) [*Debaryomyces neoformans*], pulmonary moniliasis (*Monilia* [*Candida*] spp.), and histoplasmosis (*Histoplasma capsulatum*), of

which *S. beurmannii* and the three last-named are known, and *B. dermatitidis* is suspected, to occur in England.

Emmons (C. W.). **Coccidiomycosis.**—*Mycologia*, xxxiv, 4, pp. 452–463, 18 figs, 1942.

Coccidiomycosis, caused by *Coccidioides immitis* [*R.A.M.*, xx, p. 577; xxi, p. 417], occurs in a benign primary form and also as a grave, progressive disease. It is common in the San Joaquin valley, and probably occurs over large areas in the arid south-western regions of the United States.

The newly disseminated spores in animal tissue or pus may be intra- or intercellular. As they enlarge, they retain their spherical shape. Budding has not been observed. A central vacuole can be seen in the early stages of enlargement and in older individuals it occupies most of the cell, the stainable cytoplasm being distributed in a thin peripheral layer. As the cell assumes the functions of a sporangium, the amount of peripheral stainable cytoplasm increases and becomes vacuolate. Cell walls are laid down along cleavage planes, delimiting an indefinite number of large protospores. The progressive formation radially and tangentially of additional septa subdivides the protospores into spores mostly 1 to 3 μ in diameter. The mature sporangium is filled with these spores. Its wall breaks, and they pass into the host tissues. This cycle is repeated, and constitutes the only parasitic growth phase of the fungus. The spores probably contain a single nucleus as a rule, but a multinucleate condition exists in the developing cell. Mitotic figures were not observed.

The saprophytic growth phase in culture is that of a mould. The grey or brownish-white colony may at first be glabrous, but aerial hyphae generally form in abundance in the centre and in a peripheral zone. The aerial hyphae may appear to break up into chlamydospores in old cultures, but if a five-day old culture is examined, it is seen that the spores are borne on well-differentiated conidiophores, which arise as specialized side branches nearly twice the diameter of the vegetative hyphae, and which may be simple or branched. Septa are formed at frequent intervals on the terminal portions of these conidiophores. Thus delimited, alternate cells increase in size and turgidity and in thickness of the wall. The intervening cells gradually cease development and lose their cytoplasm. The walls persist and hold the spores together in chains. It is suggested that these spores should be designated conidia or oidia rather than chlamydospores. As in the dermatophytes, spirally coiled hyphae are often present.

Flor (H. H.). **Inheritance of pathogenicity in Melampsora lini.**—*Phytopathology*, xxxii, 8, pp. 653–669, 2 figs., 1942.

At the North Dakota Agricultural Experiment Station the author studied the inheritance of pathogenicity in flax rust (*Melampsora lini*) by selfing and hybridizing six physiologic races [*R.A.M.*, xxi, p. 80], viz., 6, 9, and 10, originating from uredospore collections made in Minnesota in 1934, 24 (uredospore, North Dakota, 1938), and 20 and 22, both from teleutospores, the former from Uruguay (1935) and the latter from the Argentine (1937). Of these, Nos. 10, 22, and 24 were apparently homozygous for pathogenicity, the infection types of each selfed culture being identical with those of its parent on the 11 differential varieties, while 6, 9, and 20 were heterozygous, some selfed cultures of each differing from the parent in pathogenicity on the test varieties.

Avirulence was invariably dominant in crosses between the physiologic races, though on Buda dominance was incomplete. The F_1 hybrid, therefore, resembled the weaker of the two parents in pathogenicity or united the less virulent characters of each. The range of pathogenicity of a uredinial culture does not necessarily indicate its genotype, the F_1 uredinial cultures of a cross between the virulent races 22 and 24, for instance, approximating in respect of infectivity to race 2, the scope of which is comparatively restricted.

The F_2 cultures of a cross between races 6 and 24 segregated for infection types on Buda, Akmolinsk, and Bombay, a process explicable on the assumption that two pairs of quantitative factors governed the pathogenicity of the hybrid to Buda, the single independent factor pairs, with avirulence dominant, were concerned in the response of Akmolinsk and Bombay, while the pair of factors determining the infection type on Akmolinsk was linked with one of those involved in the development of the rust on Buda. The ten physiologic races theoretically possible on the basis of this hypothesis were isolated, viz., 6, 14, 2, 24, and 33 to 38, inclusive, of which the last six had not previously been described.

The pathogenic characters of the physiologic races of *M. lini* obtained by selfing and hybridization could be accounted for by Mendelian segregation and the recombination of the qualities inherent in the parents. Pathogenicity of the selfed and hybrid cultures to Akmolinsk and Bombay, the reaction of which to the rust is governed by single factor pairs, was conditioned by single pairs of independent factors. In the hybrid between races 6 and 24, pathogenicity to Buda, which possesses two pairs of factors for resistance to the former, was dependent on two factor pairs, only one of these operating to determine the reaction of Buda of the heterozygous race 20. The selfed cultures of the last-named segregated for pathogenicity in a single factorial ratio when tested on Buda. These data suggest that the pathogenic range of each physiologic race of *M. lini* is governed by factor pairs specific for each resistant or immune factor owned by the host variety.

Hotson (H. H.). **Some species of Papulaspora associated with rots of Gladiolus bulbs.**—*Mycologia*, xxxiv, 4, pp. 391–399, 1 fig., 1 graph, 1942.

From gladiolus corms attacked by *Sclerotinia* (*Botrytis*) sp. the author isolated four species of *Papulaspora*, *P. rubida*, *P. coprophila*, *P. appendicularis* Hotson, here described as new, and *P. dodgei* Conners (a name proposed for *P. gladioli* Hotson), and proved by inoculation that they were merely saprophytes in the tissue decayed by the primary infection.

Owing to the similarity of *Papulaspora* bulbils to the spore balls of *Urocystis* there has been confusion between species of *Papulaspora* and *U. gladioli* [*R.A.M.*, xx, p. 409] but, apart from more fundamental differences, the smut spore balls range from 12 to 32 μ in diameter while the ranges for the bulbils of *P. rubida*, *P. coprophila*, *P. dodgei*, and *P. appendicularis* are 20 to 48, 28 to 60 (mode 40), 24 to 64 (mode 44), and 32 to 100 μ, respectively.

In a note at the end of the paper D. L. Linder states that I. L. Conners (*in litt.*) has drawn attention to the fact that Hotson's name *P. gladioli* [ibid., xxi, p. 258] is a later homonym for *P. gladioli* Dodge & Laskaris [loc. cit.] and that it is to correct this error that *P. dodgei* is proposed.

Creager (D. B.). **Control program for Peony measles.**—*Flor. Rev.*, lxxxix, 2296, pp. 22–23, 2 figs., 1941. [Abs. in *Exp. Sta. Rec.*, lxxxvii, 2, p. 244, 1942.]

The incidence of 'measles' or 'rust' infection on peonies [chiefly caused by *Cladosporium paeoniae*: *R.A.M.*, xix, p. 541] in Illinois was reduced to a substantial degree by the application of elgetol, a proprietary dinitro-ortho-cresylate compound, as a ground spray, indicating the practical possibilities of the preparation as part of a disease control programme.

Chilton (S. J. P.). **Some pathogenic fungi occurring in the seed of Red and Subterranean Clover.**—*Phytopathology*, xxxii, 8, pp. 738–739, 1942.

Of 34 lots of surface-sterilized red clover (*Trifolium pratense*) seed under one year old cultured on potato dextrose agar at the United States Regional Pasture Research Laboratory, State College, Pennsylvania, 19 were infected by *Pleospora herbarum* [*R.A.M.*, xx, p. 306], six by *Stemphylium sarciniforme* [ibid., xx, p. 583], one by

Cercospora zebrina [ibid., xix, p. 102], and two by the unidentified causal organism of 'black patch' [cf. ibid., xvi, p. 616]. The incidence of the fungi was not high, the maximum of *P. herbarum* in any lot being 2 per cent. and that for the other pathogens under 1 per cent. *P. herbarum* and *S. sarciniforme* were the only contaminants of viable seed, the species isolated from the remaining material under one year old (the 15 lots of two or more years yielded no fungi) including *Alternaria*, *Phoma*, *Fusarium*, *Penicillium*, *Oospora*, and *Chaetomium*. From one batch of 980 seeds of *T. subterraneum*, *Sclerotium bataticola* [*Macrophomina phaseoli*], *Rhizoctonia* [*Corticium*] *solani*, and *F.* sp. were isolated four times, once, and five times, respectively.

Myers (H. E.) & Anderson (K. L.). **Bromegrass toxicity vs. nitrogen starvation.**—*J. Amer. Soc. Agron.*, xxxiv, 8, pp. 770–773, 2 figs., 1942.

The results of a study at the Kansas Agricultural Experiment Station to ascertain the cause of the 'sod-bound' condition, which is widespread in brome grass fields in the State, involving pallor and weak growth, do not support Benedict's view (*J. Amer. Soc. Agron.*, xxxiii, pp. 1108 1109, 1941) that a toxin secreted by the growing or decomposing roots of the grass is responsible, but rather point to a deficiency of nitrogen as the determining factor. The application of ammonium sulphate at the rate of 200 lb. per acre more than overcame any detrimental effect exerted by the previous stand of brome grass, either by destroying or neutralizing any such toxin or by conferring on the plants the capacity to resist it. In a greenhouse test in which lucerne was grown alternately with brome and other grasses on (*a*) four-year-old 'sod-bound' brome grass soil, (*b*) two-year-old brome grass soil (not obviously 'sod-bound'), and (*c*) cultivated soil not previously used for brome grass, damping-off was prevalent among the lucerne seedlings (which overran the grasses and prevented their proper development) except in the 'sod-bound' flat, suggesting a change in the microbial flora of the soil due to the growth of the brome grass.

Moore (M. H.) & Rogers (W. S.). **Sun scald of fruits.**—*Gdnrs' Chron.*, Ser. 3, cxii, 2914, pp. 166–167, 1 fig., 1942.

During the first week of September, 1942, peaches, apples, and tomatoes growing at East Malling, Kent, developed severe sun scald. Injury followed a period at the end of August marked by high temperatures (maximum 84°, 86°, and 82° F. on 27th, 28th, and 29th, respectively), and long periods of sunshine, with high relative humidity. All the injured fruits were directly exposed to the sun, without foliage protection.

Severely affected peaches showed a soft, round or oval, flattened, reddish-brown area, in some cases 2 in. or more in diameter, surrounded by a narrow area of exposed flesh. Wasps, bees, and *Sclerotinia fructigena* completed the destruction of the fruits.

Many apples were similarly affected, but without skin rupture. On Newton Wonder, Bramley's Seedling, and Lane's Prince Albert the brown area was frequently surrounded by a narrow halo of pale green or greenish-yellow, immediately outside which was another, mixed halo of red or orange-red with a sharply defined inner edge, the outer edge shading off into the normal colour of the fruit. Almost all the severely affected fruits that remained on the trees finally became infected with brown rot (*S. fructigena*). On Allington Pippin the scald area was suffused, often very sunken, variable in colour, though generally dark or purplish-red, and typically forming an arc, but sometimes extending all round the apple and enclosing a healthy area. Worcester Pearmain apples showed only a slightly sunken area of intensified deep red. When severely injured, all varieties showed brown discoloration of the flesh beneath the affected area, and in many cases the sun scald was accompanied by water core [*R.A.M.*, xix, p. 353].

Affected Conference and Beurré Superfin pears were also observed, the abnormality in this case being a predominantly orange discoloration. On outdoor tomatoes the affected areas resembled those on certain apples, except that the high colour contrasts

were much less pronounced. The tomatoes became affected before they were ripe; the damaged areas were irregular, yellowish, and slightly sunken, forming saucer-like, hard, dry, corrugated depressions.

It is suggested that in small gardens it might be practicable to shade the fruit (especially peaches on walls) during very hot sunshine with muslin.

PLANK (R.). **Zur Theorie der Kaltlagerkrankheiten von Früchten.** [A contribution to the theory of the cold storage diseases of fruits.]—*Planta*, xxxii, pp. 364–390, 1941. [Abs. in *Chem. Zbl.*, cxiii (ii), 8, p. 910, 1942.]

On the basis of copious statistical data, supplemented by the results of experimental work at the Karlsruhe Technical Institute, the writer has devised mathematical formulae whereby the reaction of fruits to cold storage diseases may be forecast.

NATTRASS (R. M.). **Notes on plant diseases, Apple mildew.**—*E. Afr. agric. J.*, viii, 2, pp. 101–102, 1 fig., 1942.

In this brief, popular note on apple mildew [? *Podosphaera leucotricha*: *R.A.M.*, xviii, p. 784] and its control, the author states that in the higher regions of Kenya the King of Tompkin's County variety is often severely affected.

CARPENTER (J. B.). **Moldy core of Apples in Wisconsin.**—*Phytopathology*, xxxii, 10, pp. 896–900, 1 graph, 1942.

The symptoms of mouldy core of apples, which is prevalent, though of minor economic importance, in the Dudley and Delicious varieties in Wisconsin, were found to agree with those described by Brien from New Zealand [*R.A.M.*, xvi, p. 688] and Harrison from Nova Scotia [ibid., xiv, p. 592], consisting essentially in the permeation and darkening of the endocarp walls and seeds, the occlusion of the core cavity by a grey mycelial weft (in advanced stages), and incipient core rot with the onset of maturity, accompanied in the two varieties under observation by a precocious development of the yellow ground colour. An *Alternaria* of the *A. tenuis* group was the predominant organism in the mouldy fruits in 1939, 1940 and 1941, other fungi present including species of *Coniothyrium*, *Fusarium*, and *Hormodendrum*. Frequently in the Delicious variety, and less commonly in the Dudley, a calycine sinus unites the central core chamber with the calyx tube, but in its absence the distal end of the core cavity was separated from the calyx tube only by a thin layer of tissue. Inasmuch as several species of fungi were present in the calyx basin on dead floral remnants, the *Alternaria* appears to possess remarkable facility for entering the core and establishing itself.

COOLEY (J. S.). **Factors affecting distribution and severity of black root rot of Apple trees.**—*J. agric. Res.*, lxv, 6, pp. 299–311, 1942.

Black root rot of apple, due to *Xylaria mali* [*R.A.M.*, xvii, p. 827], is stated to be known only in the United States, where it occurs from Pennsylvania to Georgia and westwards to Arkansas, causing the greatest losses in the central and southern parts of this range. Although the factors influencing the distribution of this disease are as yet unknown, there are reasons to believe that temperature and genetic differences in the parasite might be of importance generally, while locally incidence may also depend on various conditions predisposing the host to attack. The disease is mostly encountered in bearing orchards, young trees and replants being only occasionally affected.

In inoculation experiments begun in 1933 in Virginia and later continued in Maryland, inoculations with agar cultures of the parasite and with small chips of infected wood placed in contact with the roots of seedling apples were not successful, whereas inoculations with fairly large pieces of infected apple twigs gave good results. Wounding did not appear necessary for either natural or artificial infection. The optimum temperature for growth of the fungus in agar culture was about 25° C., although fair

growth occurred at 15°. Roots of stored apple seedlings were infected at 15·5°. The 27 different isolates of the fungus used for inoculating one-year-old seedlings exhibited wide variation in pathogenicity, infection after six weeks ranging from 0 to 100 per cent. and the average length of the lesion caused from 6·6 to 42·5 mm. When apple, pear, plum, cherry, and peach seedlings were inoculated with *X. mali*, only the apple was undoubtedly susceptible; pear and cherry developed small lesions, but these were healed over by the next year. Analysis of variance of data from resistance tests made over three or four successive years showed only slight significance for variety in the 19 own-rooted standard apple varieties tested, and no significance for variety in the 30 seedling clones and in the seedlings of nine named apple varieties. Statistical analysis of the infection data showed a significant correlation between infection and season with high temperature during the 49 days after inoculation. Longevity of the fungus in infected apple roots was found to vary. In some experiments the fungus died within a few months after the death of the host; in some natural infections, on the other hand, it survived the host by several years.

HILDEBRAND (E. M.). **Indexing Cherry yellows on Peach.**—*Phytopathology*, xxxii, 8, pp. 712–719, 2 figs., 1942.

The cherry yellows [*R.A.M.*, xxi, p. 442] virus was transmitted from diseased (mostly Montmorency) to healthy cherry trees with the development of definite yellow-leaf symptoms within about a year, and was further communicated by budding in the late summer from infected cherries to healthy Elberta peach seedlings, which contracted die-back and a stunted rosette condition during the next growing season. On the removal of the shoot above the bud from four-year-old Elbertas, about a week after budding, the stub died back several inches below the diseased bud within a month.

In the first indexing experiment, involving the insertion of diseased cherry buds between two rapidly growing shoots on cut-back second-year Elberta peach grafts, chlorotic ring-spot symptoms were manifested within a fortnight of budding, while ring spot and rosette developed in the course of a month on yearling peach seedlings indexed with cherry buds affected by yellows and cut back to one node above the diseased bud: the incubation period was reduced to about three weeks on small (18-in. tall) seedlings in four different tests.

This rapid indexing technique promises to advance the work on cherry yellows, and may, with some modifications, prove generally applicable to studies on other stone-fruit viruses.

TUCKER (C. M.). **Scald of Sweet Cherry nursery stock caused by Bacterium syringae.**—Abs. in *Proc. Mo. Acad. Sci.*, v, 4, pp. 91–92, 1940.

Bacterium [*Pseudomonas*] *syringae* was isolated from the 'scalded' leaves and stems of sweet cherry nursery stock in Missouri, and inoculated with positive results into the same host, lilac, and other plants subject to infection by the organism. Under natural conditions (particularly in poorly drained soils) the leaves are attacked at a very early age, the spots then formed being small, circular, and light brown, with a reddish halo. As the leaves expand, the necrotic tissues drop out, leaving irregular holes. Stem infections occur near the growing tips, and are characterized by long, narrow streaks, water-soaked at first, later turning light brown to nearly black, while a copious flow of colourless or pale amber gum is exuded through the ruptured cortex. Marked curvature and deformation of the stem results from the arrest of growth on the invaded side. The leaf axils may also be attacked, in which case small, brown cankers are formed on the stems; these may be girdled and killed, while the buds, and occasionally the subtended leaves, also die. With the advent of warm, dry weather, the extension of the cankers ceases, and the formation of callus under the blackened cortex finally leads to the sloughing-off of most of the dead tissue.

MAIER (W.). **Ausmass, Ursache und Verhütung der Monilia-Fäule bei Aprikosen.** [Extent, cause, and prevention of the *Monilia* rot of Apricots.]—*Angew. Bot.*, xxiv, 3–4, pp. 303–321, 4 figs., 2 graphs, 1942.

Pursuing his studies in the Rhine Province on the apricot rot caused by *Monilia* [*Sclerotinia*] *fructigena* and *M. cinerea* [*S. laxa*: *R.A.M.*, xxi, p. 460], the author cites some statistics indicating the scope of the disease in 1939 and 1941. In the former year the percentage of rotted fruits on five trees was 63·1; in the latter the incidence of infection on six ranged from 14·9 to 33·3 per cent., the number of affected apricots on eight severely diseased branches from 30 to 72 per cent., while every one of the 176 fruits on an unharvested tree on 20th August was uneatable. The examination of some 500 rotten apricots showed that in almost every instance (at least 98 per cent.) the pathogen had gained ingress either through an apical cleft or by way of unilateral fissures. During August, 1941, 3,465 out of 7,290 apricots inspected (47·5 per cent.) were found to be attacked, almost exclusively through these channels, the incidence of invasion (0·5 per cent.) through a crack in the middle of the groove transecting the fruits being negligible for practical purposes. Only in 1·3 per cent. of the total did a single fruit show both apical and lateral injuries.

Of 29 varieties investigated, 17 showed over 50 per cent. injury, the most susceptible being Red Muscadine, Souvenir of Möhrlein, St. Jean, Royal, Redcheeked Early, Werder, Nancy, Triumph of Treves, Beauge, Pineapple, Syrian, Erfurt Early, Pineapple, Della Bella, Souvenir of Breda, Boulbon Early, and Large Fruit, with 69·9, 69·2, 67·9, 63·1, 60·2, 61·3, 60·1, 60·1, 60, 56·2, 56·2, 54·2, 54·1, 51·4, 50·7, and 50·7 per cent., respectively, and the most resistant Souvenir of Robertsau, Camper Sour, Holubs Sugar, and Uhlhorns Wonder, the corresponding figures for which were only 18·6, 8·1, 15·1, and 7·4 per cent., respectively. In 11 varieties less than 10 per cent. of the fruits developed apical clefts, and in 11 a maximum of 10 per cent. showed lateral fissures, three varieties, viz., Camper Sour, Holubs Sugar, and Uhlhorns Wonder, being common to both groups. Generally speaking, a high incidence of clefts connotes few cracks and vice versa. The frequency of cleft wounds decreased during the August ripening period, while the number of fissures increased.

The relation of meteorological factors to the injuries under observation is discussed, and the possibility that persistent humidity and a change from dry to wet weather are responsible for the formation of cracks and clefts, respectively, is envisaged. It is not improbable, however, that varietal idiosyncrasies are also concerned in the reaction of the fruits to these influences at a critical period in their development, Jony, Uhlhorns Wonder, and R1, B2, for instance, being resistant to apical cleavage, and Camper Sour, Moorpark, and Uhlhorns Wonder to lateral cracking.

The best hope of control would appear to lie in the breeding of resistant varieties (in which connexion attention is drawn to the importance of the fruit rot in paving the way for the even more serious die-back of the branches involving the destruction of the entire tree) already described [loc. cit.]. Supplementary cultural precautions should be directed towards methods of cultivation and pruning calculated to counteract excessive soil and atmospheric humidity, but little is to be expected from the application of these practices in the absence of a systematic breeding programme.

Proprietary products for the control of plant pests and diseases.—*Gdnrs' Chron.*, Ser. 3, cxii, 2915, p. 171, 1942.

With the concurrence of the Agricultural Improvement Council, a scheme by which official approval can be extended to proprietary fungicides and insecticides has been agreed upon by the Agricultural Departments in Great Britain and the Association of British Insecticide Manufacturers, and a Committee under the chairmanship

of Professor J. W. Munro has been appointed by the Minister of Agriculture and the Secretary of State for Scotland in consultation with the Agricultural Research Council to advise on applications made by manufacturers for the approval of their products.

The principles and conditions of approval are to be drawn up by a joint panel composed of the members of the above-mentioned Committee, together with four representatives of the Association of British Insecticide Manufacturers, a representative of the Government Chemist, and a representative of the Agricultural Research Council.

Further details may be obtained from the Secretary of the Committee, Plant Pathological Laboratory, Ministry of Agriculture, Milton Road, Harpenden, Hertfordshire.

DIMOND (A. E.), HORSFALL (J. G.), HEUBERGER (J. W.), & STODDARD (E. M.). **Role of the dosage-response curve in the evolution of fungicides.** —*Bull. Conn. agric. Exp. Sta.* 451, pp. 631–667, 16 figs., 1941. [Abs. in *Exp. Sta. Rec.*, lxxxvii, 2, pp. 230–231, 1942.]

The laboratory testing of fungicides provides a design which might well be more closely followed in field experiments. Under the former conditions a fungicide is tested at a number of dosages, data being secured on the extent of spore inhibition by each [*R.A.M.*, xxi, p. 424]. Plotting of these data on a logarithmic probability grid usually yields straight lines, but there are two noteworthy exceptions to this rule, in one of which the dosage-response curve consists of two or more linear segments, the whole curve constituting a broken line [ibid., xx, p. 543], while in the other, discussed in the present study, the curves exhibit peaks of toxic action. Both anomalies are explicable by the assumption that the toxicant dissociates (or associates) in water, and that the toxicity of the dissociated molecule differs from that of the undissociated. Fundamental properties of fungicides derivable from the linear type of dosage-response curve are the LD-95 or LD-50 (i.e., the lethal dosage for 95 or 50 per cent. of the treated spores), and the slope of the dosage-response curve, the latter meriting inclusion in the methods of fungicidal evaluation. LD-95 values depend on the fungicide, the species of fungus, age of culture, and spore load, as well as on the slope itself; slope may be affected by the test organism and is increased by any environmental factor contributing to the well-being of the latter. With all other factors constant, slope is likewise a property of the fungicide.

The slope of the dosage-response curve further gives an indication of the significance of tenacity. Generally speaking, fungicidal preparations presenting flat dosage-response (or dosage-control) curves need not have such high tenacity values as those with steep ones. Characteristics of an effective fungicide include low LD-95 and LD-50, flat dosage-control and dosage-response curves, or (if these be steep) high tenacity. The assumption of a correlation between laboratory and field conditions for fungicidal trials is postulated and the supporting evidence discussed. The efficacy of fungicidal action is shown to be markedly improved by more thorough coverage of the plant. The inconsistent results frequently obtained with two fungicides in repeated comparative tests, one material giving better performance in some cases than in others, is explicable on the hypothesis that the reversal effect is due to the crossing-over of dosage-control curves and to the differential shift in slope of the latter with modifications in the environment. The suggestion is made that in field experiments fungicides may be more quantitatively compared by measuring the dosage of each required to produce the same level of disease control, rather than by the calculation of the disease control levels secured by the application of single fungicidal dosages. This method involves the application of each fungicide in a dosage series.

Banerjee (S.). **Fusarium equiseti (Cda.) Sacc. (= Fusarium falcatum App. et Wr.) causing a leaf-spot disease of Eichhornia crassipes Solms. Part I.**—*J. Dep. Sci. Calcutta Univ.*, N.S., i, 3, pp. 29–37, 1 pl., 35 figs., 1942.

The species of *Fusarium* isolated from the diseased leaves of water hyacinth (*Eichhornia crassipes*) in a tank at the Calcutta University College of Science in 1930 was identified by H. W. Wollenweber as *F. equiseti*, pure cultures of which were grown on various standard media. The affected foliage bore yellowish to reddish, later dark to blackish-brown spots and streaks, coalescing to cover the entire leaf surface, both sides of which were involved. The infected areas gradually shrivel, but the resultant injury was only slight, the plants surviving for a considerable period with the emergence of adventitious leaves. Inoculation experiments on wounded and uninjured leaves were nearly all successful, but again the damage was unimportant and the progress of infection very slow owing to the high power of resistance of the host.

Ministry of Agriculture & Fisheries [of England and Wales]. Advisory Leaflets.

The following advisory leaflets have been amended: 204 (*Botrytis cinerea* causing gooseberry die-back); 253 (crown gall caused by *Bacterium tumefaciens*); 273 (*Sphaerotheca mors-uvae* on gooseberry); 277 (currant reversion); 279 (*Spondylocladium atrovirens* on potato); and 290 (potato spraing, internal rust spot, and net necrosis).

In Advisory Leaflet 38, which has been rewritten, a brief, popular account is given of the symptoms, sources of infection, prevention, and control of tomato mosaic [*R.A.M.*, xx, p. 607], together with short notes on tomato streak [ibid., xx, p. 430] and mixed-virus streak [loc. cit.].

To prevent mosaic, tomato seed should be taken from soft, ripe, unblemished fruit grown on vigorous plants free from mosaic mottling. The soil should be as free as possible from tomato debris, and should be sterilized. Even growth must be maintained throughout the life of the plants. Workers should not smoke while handling the plants and should wash their hands after pruning in each house.

Severe streak is most likely to appear when tomatoes grown under conditions of high temperature and excessive moisture suffer from potash deficiency or sudden drought. Sulphate of potash may in such cases be advantageously applied to induce a more balanced growth, followed by a balanced top-dressing.

Attack by mixed virus streak may be avoided by not growing tomatoes near potatoes and removing any volunteer potatoes found.

Greathouse (G. A.), Klemme (Dorothea A.), & Barker (H. D.). **Determining the deterioration of cellulose caused by fungi. Improvements in methods.**—*Industr. Engng Chem.*, Analyt. Ed., xiv, 8, pp. 614–620, 2 figs., 7 graphs, 1942.

At the Bureau of Home Economics, Department of Agriculture, Washington, D.C., the authors developed a standardized quantitative method for the estimation of fungal decomposition of cellulose [*R.A.M.*, xxi, p. 534], the material selected for the experimental work being bleached, degreased, 8-oz. Army cotton duck, cut into strips and cultured on a liquid medium, the formula for which is given.

Metarrhizium sp. and *Chaetomium globosum* were found to cause very rapid decomposition of the material, the loss in breaking strength of the fabric after seven days through the action of these fungi being estimated at 94·9 and 81·5 per cent., respectively. As test organisms for the purpose in view they are superior to *C. elatum*, *Alternaria* sp., *Cladosporium* sp., and *Stachybotrys papyrogena*. The hydrogen-ion concentration of the substratum appears to exert a strong influence on the activity of the cellulose-destroying fungi, all of which, except *Chaetomium globosum*, caused a greater loss in breaking strength at P_H 7 or less.

Smith (G.). **An introduction to industrial mycology.**—Second edition. xii+260 pp., 136 figs., London, Edward Arnold & Co., Ltd., 1942. 20*s*.

The second edition of this useful text-book on industrial mycology [*R.A.M.*, xvii, p. 829] provides, in addition to some minor alterations and additions, a new key to the Hyphomycetales and includes a number of new illustrations.

Crowell (I. H.) & Lavalee (E.). **Check list of diseases of economic plants in Canada.**—68 pp., Dominion Department of Agriculture, 1942. [Mimeographed.]

This check list is a compilation of data on diseases of economic plants in Canada which have been accumulating for many years in the literature of the subject and in the notes and records of Canadian workers. The information given is arranged alphabetically under the Latin names of the hosts, and the causal organisms are similarly listed under each host. English and French common names of the hosts and their diseases are given and the distribution of each disease in Canada is briefly indicated.

In the introduction (given in English and French) the authors state that in compiling the list they have observed the following practices. The names 'root rot', 'stem rot', and 'basal rot' are applied to diseases whose causal organisms are known to be confined to the root, stem, and base (including the lower part of the stem and roots), respectively. Other names, such as crown rot, collar rot, and foot rot are not employed except in special cases. To obtain the common name of a disease the genus name of the causal organism is prefixed to the name indicating the type of disease; and the genus name, so used, is employed as an adjective and spelt with a small letter, e.g., 'alternaria leaf spot'. These rules do not, of course, apply to established names. The List of Common Names of British Plant Diseases has been used as a model throughout. A supplement dealing with the diseases of forest trees is in course of preparation.

Hayes (H. K.) & Immer (F. R.). **Methods of plant breeding.**—xii+432 pp., 24 figs., 5 diags., 8 graphs, New York & London, McGraw Hill Book Company, Inc., 1942. £1. 8*s*.

The purpose of this valuable book 'is to summarize the methods of plant breeding that have been developed for particular categories of crop plants, to explain the reason why particular methods are chosen for certain types of crop-improvement problems, and to give methods of field-plot technique and of statistical analysis that are adapted for particular uses'. Every aspect of the principles and techniques involved, including those relevant to the problems of breeding for resistance to disease, receives adequate attention. Among others the following important diseases are dealt with: stem rust of cereals (*Puccinia graminis*), leaf rust of wheat (*P. triticina*) and crown rust of oats (*P. coronata*), wheat bunt (*Tilletia tritici*) [*T. caries*], loose and covered smuts of oats (*Ustilago avenae* and *U. levis* [*U. kolleri*]), covered and intermediate smuts of barley (*U. hordei* and *U. medians*), wheat and barley fusarial head blight or scab [*Gibberella zeae*], maize smut (*Ustilago zeae*), loose and covered smuts of sorghum (*Sphacelotheca cruenta* and *S. sorghi*), head smut of sorghum and maize (*Sorosporium reilianum*), flax rust and wilt (*Melampsora lini* and *Fusarium lini*), and (with special emphasis on back-crossing) cantaloupe powdery mildew (*Erysiphe cichoracearum*) and snapdragon [*Antirrhinum majus*] rust (*P. antirrhini*). The chapter dealing with seed production defines the objects of potato seed certification (now practised in 22 States of the American Union), and gives the disease tolerances allowed (in Maine).

Thirumalachar (M. J.). **Olpidium uredinis parasitic within the urediospores of Hemileia canthii Berk. & Broome.**—*Curr. Sci.*, xi, 9, pp. 363–364, 3 figs., 1942.

Numerous uredospores of *Hemileia canthii* collected in Mysore State were hyperparasitized by *Olpidium uredinis*, which destroyed the cell contents and prevented

germination. A single uredospore of the rust contained up to nine hyaline, ovate or spherical sporangia of *O. uredinis*. Division of the sporangial contents into zoospores was observed, and in one case the formation of the exit tube traversing the uredospore wall was detected. The hypnospore may be distinguished from the sporangium by its thick wall, the exospore being smooth and hyaline.

Yarwood (C. E.) & Hazen (W. E.). **Vertical orientation of powdery mildew conidia during fall.**—*Science*, N.S., xcvi, 2492, pp. 316–317, 1942.

The authors' observations of the ellipsoidal spores of *Erysiphe graminis* and *E. polygoni* falling through the air in a glass tube showed that approximately equal numbers fell in the horizontal and vertical positions. This result appears to disagree with the principle stated by A. H. R. Buller (Researches on Fungi, II, p. 35, 1922) that the tendency is for elongated spores to assume the horizontal position during their fall.

Frampton (V. L.), Linn (M. B.), & Hansing (E. D.). **The spread of virus diseases of the yellows type under field conditions.**—*Phytopathology*, xxxii, 9, pp. 798–808, 1 fig., 1 diag., 4 graphs, 1942.

In this paper a differential equation is developed to describe the spread of virus diseases of the yellows type under field conditions on the assumption that the movement of the insects involved is random, that the number of plants infected is proportional to the number of plants that have been fed upon, and that spread from plant to plant within the field is of small importance. Data obtained from experiments on potato yellow dwarf and on endive infected by aster yellows virus under conditions such that the insect population of the newly ploughed field was negligible, that the insect reservoir was not substantially depleted during the course of the experiment, and that the effects at the ends of the fields were neglected, satisfied demands made by the integrated form of the equation.

Porter (J. N.). **The mycorrhiza of Zeuxine strateumatica.**—*Mycologia*, xxxiv, 4, pp. 380–390, 6 figs., 1942.

The orchid *Zeuxine strateumatica*, a native of south-eastern Asia, was first reported in Florida in January, 1936, and by June, 1938, was spreading rapidly throughout the peninsula. A radially growing fungus uniformly isolated from the roots and rhizomes was identified as *Rhizoctonia mucoroides*, the individual cells of the chains of conidia averaging 21 by 15 μ and the hyphae 6·4 μ in diameter.

Seeds of *Z. strateumatica* sown on cultures of the fungus growing on a slightly modified Burgeff's 'Sb' medium germinated in six to eight months from the time of sowing, better germination taking place in diffuse light than in the dark, whereas no germination occurred with seeds sown without the fungus on Knudson's medium.

The investigation is considered to offer clear indication that *R. mucoroides* is the endotrophic fungal symbiont associated with *Z. strateumatica* in Florida, though the fungus has not, apparently, previously been recorded there. The fact that it has now been isolated from *Zeuxine* spp. in both Java and Florida supports the view that there is a very close and specific relationship between orchids and their endotrophic symbionts. Since the orchid develops very rapidly it is suggested that it may prove a satisfactory subject for experimentation on orchid mycorrhiza.

Thompson (J. K.). **Potatoes—an experiment on the control of blight (Phytophthora infestans).**—*Kirton agric. J.*, *1939*, 3, pp. 7–28, 2 figs., 1939.

A detailed account is given of the results obtained at Kirton, Lincolnshire, from 1936 to 1938 in the control of potato blight (*Phytophthora infestans*) by dusting with copper fungicides.

The results from a series of trials to test the efficiency of copper-lime dusts

containing 10, 15, 20, and 24 per cent. metallic copper showed that the use of dusts containing as little as 10 per cent. copper is inadvisable however fine the dust, while the dust containing 24 per cent. copper depressed the yield in one season although it gave the most effective blight control. The keeping of the foliage covered with fungicide at all critical periods is of much importance.

In a second series of trials with copper sulphate and calcium carbonate or hydrate dusts prepared by different methods there were no significant differences between the effects of the different dusts, but the significant results obtained from treatment against no treatment emphasised the value of dusting.

Goss (R. W.) & Jensen (J. H.). **Susceptibility of Solanum species to Fusarium solani var. eumartii.**—*Phytopathology*, xxxii, 10, p. 913, 1942.

In tests at the Nebraska Agricultural Experiment Station of the tuber-bearing species of *Solanum* supplied by D. Reddick for their reaction to *Fusarium solani* var. *eumartii*, the following proved susceptible: *S. acaule*, *S. demissum* (Reddick 178, 418, and 519), *S. chacolense*, *S. commersonii* ('Blanca' and 'Colorado' from the Argentine), a species from Chili (P. I. 129381), and *S. antipoviczii*.

Krantz (F. A.) & Lana (E. P.). **Incidence of hollow heart in Potatoes as influenced by removal of foliage and shading.**—*Amer. Potato J.*, xix, 7, pp. 144–149, 1942.

The removal of 50 to 80 per cent. of the foliage at successive stages in the development of Irish Cobbler potato plants at the North Central branch (Grand Rapids) of the Minnesota Agricultural Experiment Station in 1940 and 1941 caused a decrease in the number of hills free from hollow heart [*R.A.M.*, xxi, p. 537] when carried out at tuber-setting time (9th July), but not at later stages. Shading the plants with black sateen cloth for intervals of five or ten days tended to increase the number of hills free from hollow heart when carried out at tuber-setting time, but had no effect later on. The incidence of the disease was approximately equal in hills harvested at an average hill weight of 157 gm. and an average tuber weight of 7·5 gm., and at maturity, when the corresponding figures were 776 and 53 gm., respectively. The removal of 20 to 80 per cent. of the foliage did not significantly influence the average number of tubers set per hill, the mean yield per hill, or the mean weight of the individual tubers. It is suggested that the active renewal of vegetative growth following the removal of the foliage in the early period of tuber enlargement may have been responsible for a temporary nutritional deficiency inaugurating the hollow-heart condition.

Clinch (Phyllis E. M.). **The identity of the top-necrosis virus in Up-to-Date Potato.**—*Sci. Proc. R. Dublin Soc.*, N.S., xxiii, pp. 18–34, 1 pl., 1942.

In further studies at Glasnevin on the top-necrosis virus from Up-to-Date potatoes (= 'streak' virus, virus B, *Solanum* virus 4) [*R.A.M.*, xxi, p. 265], the author found that of 39 potato varieties tested, the majority reacted with top necrosis when grafted with scions from Up-to-Date potatoes carrying streak. All the others showed a transient mottle resembling that in Up-to-Date, except Irish Chieftain, which carries virus A, and reacted with crinkle (X+A).

Sap inoculation of the streak virus from Up-to-Date to healthy potato plants belonging to intolerant varieties gave rise to local necrotic lesions and on rare occasions to systematic necrosis. The virus was readily transmitted to tolerant varieties. Sap inoculation from Up-to-Date potatoes to *Datura stramonium*, tobacco, tomato, and *Lamium hybridum* gave mild mosaic symptoms of the virus X type, the presence of the streak virus being demonstrated by return grafts to potato.

The X-immune Seedling 41956 resisted infection with any virus from Up-to-Date and with virus X, but it was readily infected with potato viruses Y, A, stipple streak, F, and top-necrosis strain of F. Dykstra's claim that B could infect 41956 [ibid., xv, p. 310] could not be substantiated [cf. also ibid., xviii, p. 410]. When 41956 was

inserted as an intermediate scion between Up-to-Date and a susceptible basal stock in double-grafted plants, the virus content of Up-to-Date passed unchanged into the basal stocks. In similar double grafts where the Up-to-Date top scion was replaced by X-infected President, no resistance was shown by the intermediate 41956 scion to the downward passage of X. The 41956 scions did not become infected with X, or with any virus from Up-to-Date.

The removal of X from Up-to-Date sap by precipitation with anti-X rabbit serum resulted in the simultaneous removal of the virus responsible for streak.

The physical properties of the Up-to-Date streak virus resembled those described for viruses of the X type. The streak virus could not be introduced by sap inoculation to potato or *D. stramonium* plants already infected with X, but this immunity of X-infected plants to streak or other strains of X no longer obtained when the second virus was introduced by grafting.

When inoculated with sap from Up-to-Date plants affected with streak, healthy potatoes of intolerant varieties occasionally showed systemic infection with a non-necrotic X virus, though similar plants inoculated with a mixture of streak sap and X-infected sap all developed systemic X infection. It is suggested that the non-necrotic X virus may be a variant of the Up-to-Date streak virus in the local lesions.

It is concluded that the streak virus in Up-to-Date is a strain of X, differing from typical X only in its effects on certain potato varieties. The existence of a non-necrotic strain of X in conjunction with the top-necrosis strain in Up-to-Date has not yet been proved. The reason why virus X is unable to multiply in seedling 41956 is unknown, but it may be that some factor essential for its synthesis is lacking in this seedling. Evidence is presented of a correlation between movement of the Up-to-Date virus and food translocation.

Ryker (T. C.) & Douglas (W. A.). **Rice disease investigations : root rot studies.**—*Rice J.*, xliv, 12, pp. 9–11, 1941. [Abs. in *Exp. Sta. Rec.*, lxxxvii, 2, p. 232, 1942.]

In pot tests at the Louisiana Agricultural Experiment Station rice plants inoculated with *Pythium* sp. alone contracted only slight infection of the root system, whereas those into which the pathogen was introduced in company with the root maggot *Lissorhoptrus simplex* developed severe injury. Field observations indicated that both the fungus and the insect were associated with root rot, but that either alone might occur without inducing root symptoms, denoting the possible secondary role of environmental factors. Over a two-year period of investigation high soil temperatures and a low state of fertility were found to favour the root rot, while beneficial effects followed the application of fertilizers and the drainage of the fields.

Kuilman (L. W.). **Uitstoeling en bloei van de Rijstplant III. Vatbaarheid van de (op voedingsoplossing gekweekte) variëteit Oentoeng voor Piricularia oryzae Cav.** [Tillering and flowering of the Rice plant III. The susceptibility of the Oentoeng variety (grown in a nutrient solution) to *Piricularia oryzae* Cav.]—*Meded. alg. Proefst. Landb., Batavia*, 45, pp. 27–32, 1 fig., 1940. [English summary.]

It was observed in nutrient solution cultures of the Oentoeng rice variety at the Agricultural Experiment Station, Buitenzorg, Java, that virulent attacks of blast (*Piricularia oryzae*) coincided with the close of the first period in the development of the plant, when tillering is interrupted by the elongation of the stems, which begins at about the age of 55 days. The pathogen destroyed the plants about a week after the onset of the outbreak, completely preventing growth in height but not in breadth. In one plant, which succumbed some days later than the rest, a certain amount of internodal elongation took place, thereby clearly demonstrating the responsibility of *P. oryzae* for the stunted condition.

TIMONIN (M. I.). **The interaction of higher plants and soil microorganisms: III. Effect of by-products of plant growth on activity of fungi and Actinomycetes.**—*Soil Sci.*, lii, 5, pp. 395–408, 3 pl., 1941.

This third contribution to the present series of papers [*R.A.M.*, xx, p. 29; xxi, p. 256] describes comparative studies of the rhizosphere of Bison and Novelty flax, resistant and susceptible, respectively, to *Fusarium lini*, which demonstrated that the incidence of *Alternaria tenuis* (group), *Cephalosporium humicola*, *Fusarium bulbigenum*, *F. culmorum*, *F. oxysporum*, *F. solani* var. *martii*, *Helminthosporium sativum*, and *Verticillium chlamydosporium* was relatively reduced, and that of *Mucor hiemalis*, *M. racemosus*, *Cladosporium herbarum*, *Penicillium chrysogenum*, *P. intricatum*, *P. janthinellum*, *P. lilacinum*, *P. restrictum*, *P. terrestre*, *Trichoderma viride*, and *T. album* increased by the rhizosphere effect of the resistant as compared with the susceptible variety.

When the solutions in which plants had been grown were allowed to diffuse through collodion membranes into the soil, the microbial activities in the vicinity of the membrane were stimulated in a manner analogous to that in the natural rhizosphere of corresponding plants. The solution after growth of the susceptible variety, when added to liquid or solid media, caused greater stimulation of growth in *F. culmorum* and *H. sativum* than did the solution after growth of the resistant variety. With *T. viride*, however, the solution after growth of the resistant variety exerted greater stimulation. The solutions after growth of the resistant variety contained 25 to 37 mg. hydrocyanic acid per plant grown as against only a trace in the case of the susceptible. Potassium cyanide, added to Crone's solution (8·2 mg. per 100 ml.), produced an effect on the growth of these fungi similar to that given by the solution after growth of the resistant variety.

The work shows that different fungi make a different response to minute quantities of hydrocyanic acid; since the resistant variety excretes this substance into the surrounding medium, it exercises a selective effect on the fungal flora of the rhizosphere. *T. viride* is of special interest in this respect, because it tolerates small amounts of the acid better than some pathogens, and is considered by some workers to control the activity of pathogenic fungi in the soil [ibid., xx, pp. 108, 492, *et passim*].

YARWOOD (C. E.). **Fungicide treatment of string supports for control of Hop downy mildew.**—Abs. in *Phytopathology*, xxxii, 9, p. 830, 1942.

Following up Magie's observations (*Phytopathology*, xxx, p. 16, 1940) as to the protective effect of the drip from Bordeaux-sprayed hops on the untreated growth, experiments were carried out in six gardens in California in 1942 to determine the practicability of impregnating the string supports with an appropriate fungicide in such a way that splashing and dripping rain would convey the disinfectant to the spores of *Pseudoperonospora humuli* on the nodes and growing points, the principal sites of infection under local conditions. The natural drip during rain from cotton strings treated with low-lime Bordeaux (7·5 per cent. copper sulphate plus 2·5 per cent. lime), diluted to $\frac{1}{20}$ its field strength, prevented the germination of the sporangia of the pathogen in watch glasses, and vines growing on strings disinfected with this compound bore 80 per cent. fewer leaf and 50 per cent. fewer nodal infections, and 78 per cent. fewer diseased basal shoots than those on untreated strings in one garden.

Report on the British West Indies Central Sugar-Cane Breeding Station for the year ending September 30th, 1941.—37 pp., [? 1942].

In this report it is stated that sugar-cane mosaic is to be found everywhere in Jamaica. At Hope Gardens it is so virulent that even reputedly resistant varieties, such as P.O.J.2878, are comparatively susceptible, while only eight miles away, at Cow Park nursery, both the incidence and the effects of the disease are only slight.

At least three strains of the disease appear to be present in Jamaica [*R.A.M.*, xx, p. 226], differing in their distribution, symptoms, and the varieties they attack. It is clear that variety resistance tests carried out in Barbados must have small validity in Jamaica, and that the mosaic reactions of varieties sent to Jamaica will have to be tested in the island itself, such reactions being determined separately for the different areas.

The B.3439 seedling has given very promising results and in certain localities is being planted commercially. Though noble, it is highly resistant to mosaic; in four plant cane tests in 1940 it gave appreciably more sugar per acre than B.H.10 (12). B.34104 makes remarkable growth as a plant and a ratoon, but is extremely susceptible to mosaic; it is, however, very tolerant of the disease, and many estates intend to plant it on a commercial scale.

EVANS (H.). **An investigation of physiological methods of determining nutrient deficiencies in Sugar Cane.**—*Ann. Bot., Lond.*, N.S., vi, 23, pp. 413–436, 5 figs., 4 graphs, 1942.

A full account is given of investigations carried out in Mauritius into the diagnosis of mineral deficiencies in sugar-cane. Leaves taken from plants grown in plots deficient in nitrogen, phosphate, or potash failed to respond to injections with 0·05 per cent. urea, 0·05 per cent. sodium dihydrogen phosphate, or 0·05 per cent. potassium sulphate, respectively. Stem injections similarly led to no increase in growth rate. Injection methods therefore do not appear to hold out much promise for the diagnosis of nutrient deficiencies of sugar-cane. On the other hand, growth responses to different soil treatments of the crop actually growing in the area concerned were found to give accurate and reliable results within two months.

FITZPATRICK (H. M.). **Revisionary studies in the Coryneliaceae.**—*Mycologia*, xxxiv, 4, pp. 464–488, 43 figs., 1942.

This paper, together with a second part expected to appear later, constitutes a revision of the writer's earlier monograph on the same group (*Mycologia*, xii, pp. 206–267, 49 figs., 1920). Descriptions, with diagnoses, are given of the seven species retained in *Corynelia*, of two species of *Tripospora* (one new), of the new genus *Coryneliospora*, its type species *C. tripos*, and *C. fructicola* n. comb., and of *Lagenulopsis* n. gen. and its type species, *L. bispora* n. comb. (syn. *Corynelia bispora* Fitz.). Keys are given to the species of *Corynelia* and *Tripospora*.

RAY (W. W.). **Notes on Oklahoma Cercosporae. II.**—*Mycologia*, xxxiv, 5, pp. 558–562, 1942.

This list of 20 species of *Cercospora* from Oklahoma includes four new to science, of which *C. corylina* on leaves of *Corylus rostrata* and *C. americana avellana*, is of special interest; the remaining 16 are recorded for the first time from this State.

ROBERTS (CATHERINE). **Morphological similarity in culture between Torulopsis pulcherrima and Taphrina deformans.**—Abs. in *Phytopathology*, xxxii, 9, p. 829, 1942.

Striking similarities were observed in three- to five-month-old cultures on potato dextrose and vegetable agars between *Torulopsis pulcherrima* and *Taphrina deformans* in respect of their cellular morphology. Two out of four isolates of *Torulopsis pulcherrima* produced globose, thick-walled cells occupied by single fat globules and with adhering remnants of cell walls. Other cells were furnished with single bud-like protrusions (interpreted by Windisch as asci [*R.A.M.*, xx, p. 382]). Similar globose, thick-walled cells with many fat globules and attached wall remnants were observed in the case of *Taphrina deformans*, as well as bud-like protrusions, some of which were

inhabited by one to three ellipsoid bodies (? ascospores). These analogies, together with such macroscopic cultural resemblances as dissociation into pigmented and non-pigmented areas, suggest a closer affinity between the two fungi under discussion than is indicated by their present taxonomic positions.

REID (J. J.), NAGHSKI (J.), FARRELL (M. A.), & HALEY (D. E.). **Bacterial leafspots of Pennsylvania Tobacco. I. Occurrence and nature of the microorganisms associated with wildfire.**—*Bull. Pa agric. Exp. Sta.* 422, 36 pp., 1942.

A full account is given of investigations carried out in Pennsylvania into the nature and identity of the organisms associated with leafspot diseases of tobacco, in the course of which 640 representative cultures (selected from 4,000 strains) of green-fluorescent Gram-negative bacteria from seed-bed soils and from plant material from seed-beds and fields were compared with known cultures [*R.A.M.*, xix, pp. 48, 679]. These 640 strains were divided into two groups, 27 monotrichous cultures conforming to the description of *Bacterium pyocyaneum*, and 613 lophotrichous strains, of which 603 were referable to *Bact.* [*Pseudomonas*] *fluorescens* and 10 to *Bact. putridum*. The group of 603 cultures of *P. fluorescens* included isolations from other laboratories as *Phytomonas tabaci* [*Pseudomonas tabaca*], *Phytomonas* [*Pseudomonas*] *angulata*, *Phytomonas primulae* [ibid., xvi, p. 256], *P.* [*Pseudomonas*] *cerasi*, *Phytomonas* [*Pseudomonas*] *vignae*, and *Phytomonas* [*Pseudomonas*] *syringae*. From serological studies on 25 representative cultures it is concluded that the organism associated with tobacco wildfire is antigenically identical with *P. fluorescens*, and that *P. angulata*, *Phytomonas primulae*, *Pseudomonas cerasi*, and, possibly, *P. vignae* and *P. syringae* are also identical with *P. fluorescens*.

Observations on the transformation of the capsular antigenicity of *P. fluorescens* on normal clover plants indicate that the antigenic specificity of the wildfire organism in the M phase is a reflection of capsular changes occurring during the reproduction of the organism as an innocuous epiphyte.

The results also demonstrate that the tobacco leaf spot organism is always present in soil and that *P. tabaca* is identical morphologically, culturally, and serologically with the common soil form, *P. fluorescens*. Hitherto it has been held that *P. tabaca* was a parasitic form that did not live independently of its host, but the complete reciprocal agglutinin absorption demonstrated in both the M and S phases between a virulent culture of *P. tabaca* and *P. fluorescens* leaves little, if any, doubt of the identity of the two forms.

As to how a normal soil bacterium such as *P. fluorescens* can suddenly become involved in such a rapidly spreading disease as wildfire, some factor may possibly arise which disturbs the balance between the tobacco plant and its normal bacterial flora, so leading to leaf spot.

The peculiar antigenic components characterizing the M phase of *P. tabaca* are enhanced by reproduction of the organism as a plant epiphyte, but it is not, therefore, to be concluded that such progressive changes in the nature of the organism conduce to sufficient virulence to overcome the resistance of a normal plant. The strain used (80) was isolated from a normal, healthy tobacco plant, which at no time showed any sign of disease, though other plants, growing under less favourable conditions in nearby plots, were severely affected. This strain was more virulent on a susceptible host than any strain obtained from other workers.

Seed-bed steaming does not eliminate the bacteria associated with leaf spot [loc. cit.], but rather results in an increase in their prevalence. Tobacco is produced as a rule in the presence of the leaf spot organisms, inasmuch as they were present in all seed beds examined and on most of the plant material. The disease is not due to the mere presence of these organisms, but to some other factor or factors.